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Index to Volume XXXII

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JOURNAL OF ELECTRICITY

POWER AND GAS

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ECONOMIC VALUE OF ELECTRIC TRANSMISSION.
BY F. G. BAUM.

DECORATIVE PERIODS APPLIED TO LIGHTING FIXTURE DESIGN.
BY F. N. COOLEY.

WASTE DUE TO NON-USE OF WATER POWER.
BY W. Y. N. POWELSON.

WATTMETER READINGS AND POWER FACTOR OF BALANCED THREE-PHASE CIRCUITS.
BY A. R. HAYNES.

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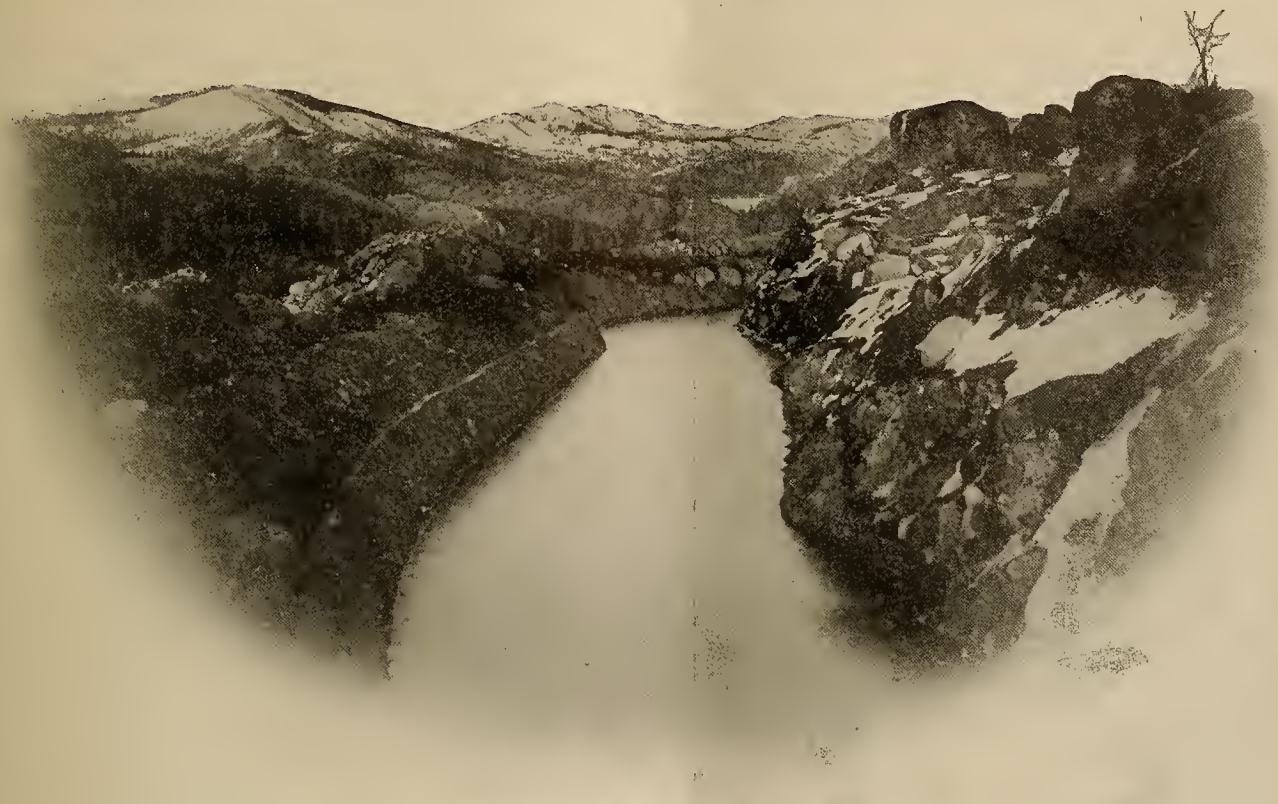
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POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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Drum Canal, Showing Spaulding Dam in Distance.

ECONOMIC VALUE OF ELECTRIC TRANSMISSION

BY F. G. BAUM.

The men who built the first electric power transmission systems in California did not realize how rapidly and to what magnitude the business would grow. Yet in a general way they did appreciate the great advantages to be gained by a power transmission system furnishing power to operate various industries from large efficient power plants, instead of each industry supplying its own power from a small inefficient plant. The economy to the consumer in any particular case could of course be determined and the saving to the power user effectively shown. But as the power transmission lines operating as a unit have become larger and made to cover more and more territory, the additional advantages of having the large power system supported by a varied series of industries have added additional economy and stability to the large systems, and have also added general benefits to the industries and communities. The total result gives strong reasons for the increase of the electric transmission systems to cover generally a wider territory and more diversified industries.

To understand the reasons for this favorable condition resulting from the introduction of the electrical transmission systems is not difficult. We need only remember that any form of mechanical power can be efficiently converted into electric power and economically transmitted over long distances, subdivided into any number of parts, and instantly reconverted into some form of useful power at the place where wanted, in order to begin to appreciate that what is occurring is in response to fundamental economic laws. The high efficiency at which electric power may be generated, transmitted, subdivided and reconverted into mechanical or other useful power at any point along the transmission system is responsible for the use of electricity as the medium of mod-

ern power transmission and the continually increasing area covered by the electric transmission systems. This widening of the territory and the increased amount of power drawn from the transmission systems has been met by the installation of larger and larger generating units, until single units of 10,000 to 20,000 horsepower are now common, and operate continuously for days and weeks with less attention than is required by a 100 horsepower engine unit in a small factory.

In order to more thoroughly appreciate the advantages obtained by a large system, we must understand that no great amount of electricity can be



Drum Power House and Pipe Line.

stored. This means that the output of the power plants feeding into the transmission system must at each instant balance the power supply drawn from the lines, plus the transmission losses. Furthermore, the electric medium of power exchange between points of production and consumption operates instantly and efficiently.

To use an illustrative analogy, the large electric system may be compared to a bank in its economic function, and the electric medium of transmission may be compared to money, the medium of property exchange. If we had no money we would have to trade by direct exchange of property, and if we had money, but no banks in which to deposit our funds from which those of us who need it might draw, the difficulties of doing business may be imagined. Without a central power distributing system each consumer must develop his own power and have some surplus power. Hence there is no medium of exchange, no means of "banking" the total power of all on the transmission system, and no drawing at such points and in such amounts as may be needed from time to time. Electric transmission provides the elastic medium for exchanging any kind of mechanical power to any other form of mechanical power at some point on the system.

If one hundred isolated power plants are connected together by a transmission system and their power producing possibilities concentrated we will then be able to supply the demands of the one hundred original consumers and have a fair sized surplus always on hand. That is, by "banking" the individual energies through the transmission system, we all can get the convenience of the power facilities, and the system will be able to meet the demands of all its patrons and carry a surplus. This is because we have concentrated the surplus of the several plants and because our individual needs do not come at the same time. This surplus power is principally due to the fact that the diversity of interests now supplied from the one system is such that the system as a whole has a more uniform load, a better "load factor," than the separate plants when operating separately. In general, the more varied the interests which draw power from the lines, the more uniform will be the demand, and the better for the transmission system, just as the more varied the business of the bank, the more even the demands for money and the better for the bank and its patrons.

Having now connected the hundred small plants by an electric transmission system with a large power demand, we find we can no longer afford to operate the one hundred small plants, but instead we install a few large power units to supply the entire system, and by this means produce a large saving in operating expense. The economies resulting from large power systems with large central stations is in this way working a revolution in America, especially in California, and also in other countries. That this revolution is progressing from economic reasons which are fundamentally sound is certain, and therefore larger and larger electric power systems may be expected.

We may well inquire if these large power systems are to the advantage of the community as a whole, as one can see that in this revolution, as in other stages of progress, individual industries may be temporarily injured. A few simple considerations will show that electricity is one of the greatest influences for the stability of a country, for, as well known, to be stable, a country must be efficient, and it is now being more and more recognized that to be efficient it must use electric power. It is, of course, now becoming recognized that the most stable country is one in which the industries are diversified and also widely distributed.

To bring about this diversion and distribution of interests and population the influence of the electric power systems (and especially the water power systems) is probably as great as that of the railroads. Some day nearly all railroads will be simply electrically-operated mechanical devices for the transpor-

tation of such things as must be moved in bulk, that is, practically all railroads will in time be electrically operated.

The stability of any civilization depends also on the fact that it consumes less than it produces. As it is necessary with an increasing population (the natural resources of a country being fixed and limited and the population increasing) to operate more and more efficiently in order to produce more than is consumed, the most efficient methods must be employed for all operations. Nature's naturally replenished sources of power must be used instead of consuming wood, coal, oil, etc., and the most natural source of power is falling water, which nature is always reproducing.

This water power, converted into the electric form for distribution and supplied to electric appliances for conversion into the form desired at the place desired, is the most efficient and convenient system imaginable. The electric method of doing a thing tends inherently to remain efficient, for inefficiency makes its appearance as heat, and heat means trouble, and as the human being wants to avoid trouble, there is inherent reason for efficiency. Starting with water power converted to electric power we can go on producing forever any mechanical operation; we can refertilize our lands, cultivate them, harvest and transport the crops to market, cook our meals, light and heat our homes, etc., and do it efficiently.

The great problem of all ages has always been to connect the producer and the consumer, and the greatest loss in efficiency has been in this step between the producer and the consumer. If we could produce, distribute, and consume all other products as efficiently and as simply as we can electricity, this great loss between production and consumption would be reduced eighty to ninety per cent. For this reason the electrical method of doing a thing will always be the ideal. Sometime in the future a nation's civilization will be measured largely in terms of kilowatt hours consumed per human being per year, because as the kilowatt hours consumed are large, so the non-productive inefficient labor will be small. Therefore a nation having large natural water powers need never fear decay. Hence we see the general benefits accruing to all the people, an unearned increment so to speak, as a result of the electric transmission systems. The electrical transmission systems will ultimately form a network all over the country just as the railroads have gridironed the states in the past.

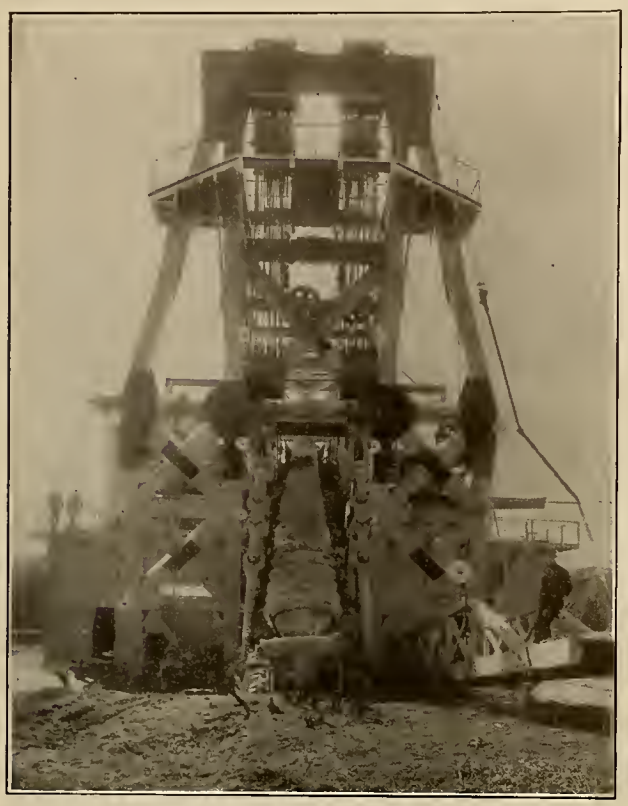


Electric Power Transmission Lines of California.

To illustrate the saving of capital and operating expenses, and the distribution of industries throughout an area, let us consider the conditions in California, especially the central part of the state, where one

of the largest systems in the world has been built up in the last fifteen years.

To more thoroughly appreciate the changes wrought in California by the hydroelectric power transmission systems, we must go back to 1897 and 1898. At that time there were independent and local



Electric Driven Gold Dredge.

steam plants in all the cities and towns of California. These plants supplied current for lighting only, and manufacturing concerns provided themselves with power from small plants which rapidly depreciated. The cost of lighting was 15c per kilowatt hour in the small towns, and power costs to manufacturing companies in most cases about two hundred dollars per horsepower year.

The mines on the Mother Lode had largely been abandoned, gold dredging had not yet proved feasible, no cement plants had yet been established, and wheat farming was rapidly declining. In a few isolated cases the farmers had begun to pump water for irrigation by means of gas engines, and lands were held at ridiculously low prices, but could not be sold, and Southern Pacific common stock, which is an index of California prosperity, was held at $30 per share because it could not be sold. It will be recalled that 1897 and 1898 were dry years, so that the farmers were praying for rain, the merchant for business, and on the whole conditions were as discouraging as seemed possible.

The only signs of hope were the several electrical plants that were starting about that time in the Sierras —"brain storms of de Sabla and Martin," they were called. Small hydroelectric plants were installed to supply power to the Grass Valley mines, and to the Mother Lode at Sutter Creek, Jackson, etc. The success of these plants caused the installation of a plant to supply power to Marysville, and caused the extension of a line from the Mokelumne River to Stockton, and the building of the first part of Colgate and a transmission to Sacramento.

As each plant was installed and the lines extended, careful measurements and tests were made to try to answer the question, "Is it feasible to transmit power commercially successful from the Sierras to the Bay of San Francisco?" The answer being in the affirmative, these bold pioneers proceeded to raise money to build the plants and lines to Oakland and San Francisco.

Most of the power is produced on various mountain streams from water power, the sources of power being about 150 miles from San Francisco. From each of these plants lines are built in the general direction leading to Oakland and San Francisco. Considering Oakland or San Francisco as the hub of a wheel, the power lines would appear as the spokes, the plants being located at the ends of the spokes. In some cases lines connect also from one plant to the other, or several plants are connected together on the rim of the wheel, bearing out the further resemblance to a wheel, the connecting lines between the plants being the felloes, or the tire connecting the spokes. On the rim of this wheel are also large power consumers made up of some large mining communities, etc., and on the spokes of the wheels are a number of cities, towns, factories, etc.; for example, Sacramento, Stockton, Oroville, Marysville, San Jose, Woodland, and many others, also several large cement plants, numerous gold dredgers, large street car systems, innumerable small factories, many small pumping plants both for irrigation and drainage, and the numerous consumers requiring light for stores, homes, and almost every conceivable use.



Reclamation and Irrigation by Electricity.

The result is, then, that power is transmitted over the transmission lines to the various points of use, the last of the water power being carried to the hub of the electric wheel, to Oakland and San Francisco. At these points large steam plants are provided for power service insurance, and to balance up the power supply and demand so that the water power plants may

as nearly as possible deliver their maximum output at all times. The arc of a circle covered by this large electric system is about 350 miles long, and the area covered is nearly 40,000 square miles, or an area sixty per cent as large as the state of New York. The average load on this system has grown to over 10,000 horsepower.

The result of such a system (and shown on the accompanying map of California) is that the same service in electric power is available at the mining camps in the mountains and to the small towns and industries in the central part of California as is supplied to the larger cities. Aside from the economies mentioned of such a system, resulting from the "banking" of the facilities, the power conditions throughout this area tend to become equalized, resulting in a distribution of population and industries not otherwise possible; and resulting in adding to the general stability of the country, and in great savings in capital and operating expenditures for the industries and cities served. Very often it enables the establishment of an industry, for example: a small factory, a rock quarry, a cement plant, a farm, etc., at a point otherwise prohibited, adding to the economic value of the district. The tendency is also to equalize rates for light and power, and to reduce rates to the lowest level. In small California cities the consumer of electric light or power gets much lower rates than ordinarily obtained in Eastern cities having local power stations.

In consequence of this electrical development industries are being established in many of the smaller towns and outlying districts where the employes can live more advantageously, and the natural effective result is a healthy growth of all parts of the state, a large saving in operating expenses, capital and resources, a general equalizing of opportunities, and on the whole a tremendous economic gain for the communities, increasing in geometric ratio. It is naturally to the interests of the people that the power systems be extended as rapidly as conditions warrant, as the resulting economies which will come from the extension of the business, will of necessity result in their benefit. For this reason, as I said before, California or any state or nation having available cheap power need never fear decay.

In California several practical illustrations may be seen in the conservation of water resources and the extension of the power systems. In one of these, flood waters are to be stored in a huge dam 300 ft. high, at an elevation of 5050 ft. above sea level, the dam alone costing over $2,000,000. After being released from the dam the water is successively passed through a series of six power houses, utilizing a total drop of 4140 ft. for power purposes, generating more than one hundred thousand constant horsepower, the water being discharged from the last power house at an elevation of 400 ft., and at this point the stored water is diverted into irrigation canals and more than 60,000 acres will be irrigated. This is practical conservation.



Electric Driven Cement Plant.

A glance at the map of California showing the development of electric transmission systems in the last fifteen years, and a knowledge of the undeveloped resources will give an idea of what has been accomplished and what may be the result twenty-five years hence. It follows that every encouragement should be given to develop water power as against steam power, in order to gain the advantages for California of the highest type of civilization, one that will endure to the end of time.

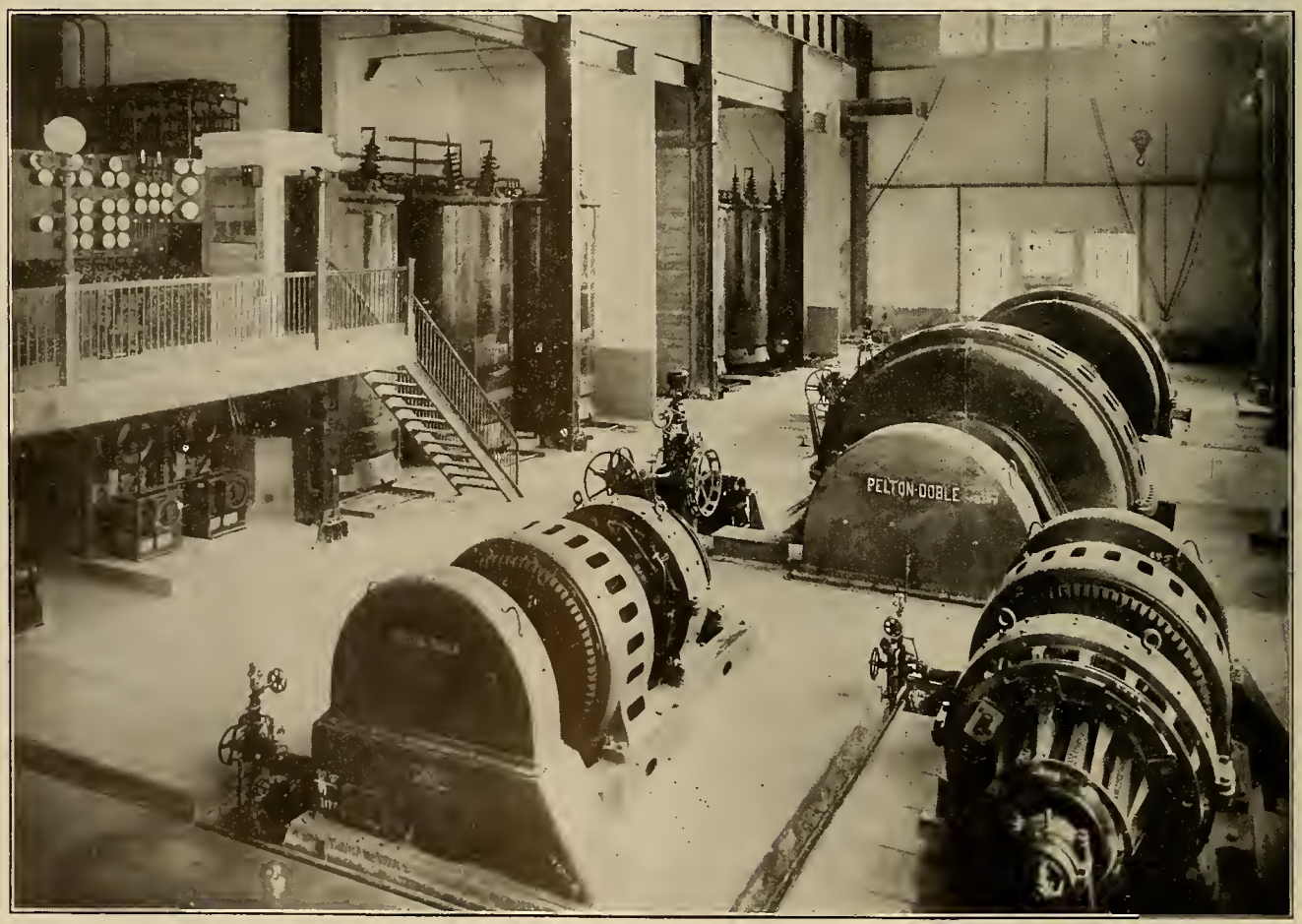
It requires no prophet to predict that within the life of most of us the steam locomotive will largely disappear, and that in its place will be the electric



Lake Spaulding Dam and Construction Plant, Present Height, 242 ft.; Ultimate, 322 ft.

motor, quietly, rapidly and effectively doing the future work of transportation, and it requires no prediction that the electric motor and other electrical devices will be largely responsible for future progress and advancement of civilization generally. In fact civilization and philosophy will be very much influenced and directed by electricity and its accomplishments. The philosophy of Marcus Aurelius and Confucius, who lived two thousand years ago is as sound as that of our modern philosophy, yet Rome decayed and China now sleeps. The electric transmission of intelligence and power would have prevented the decay of the former and would arrest the sleep of the latter. It is impossible to judge the future by the past without making full allowance for the changed conditions resulting from the modern transmission of information, power and products.

The transmission and distributing systems are gradually covering the entire state, forming an electrical metallic screen over the country. This is a screen of equal and constant potential under which service, opportunities, and rates tend to become equal. By building the transmission systems across and through the valleys of California, there is formed a system which makes for the uniform and stable development of the state as a whole. Not only this, but the hydroelectric companies use a waste to reduce a want. This gives us assurance for the future, for an increasing population requires progress, progress requires profits, profits requires efficiency, and we may claim in all modesty that modern business could not be carried on efficiently without electric power.



Interior of Drum Power House.

LIGHTING METHODS

LIGHTING METHODS INTRODUCED.

Knowledge is gained by observation and study, and through experience.

The object of this new department—Lighting Methods—is to diffuse information in such manner that by observation and study it may be converted into a valuable working knowledge for all those interested in the effective and efficient use of modern illuminants.

It is the dissemination of such practical information which makes for increased business, and results also in improved conditions.

But progress in the science of illuminating engineering, which presents the final word in methods pertaining to lighting, is so rapid that men and youths knowing but very little as a basis for their new work, have continually to be recruited. Then there is the busy man, architect, or whoever he may be who must gain knowledge of this kind in gulps. That he who runs may read, illustrated articles of installations typifying the latest developments will be published, and for the engineer, articles describing new methods and original research will from time to time also be included.

The new recruit, for the proper accomplishment of his purpose, whether he be an appliance salesman or salesmen of central station service, must begin at the beginning. The student also must commence here. The tyro, who would avoid trouble, both now and in the future, should realize the necessity for being well grounded in fundamentals, and the importance of securing accurate knowledge that the problems of those he would serve be properly solved.

While it is necessary to commence at the beginning, short cuts are possible, if not essential, and wherever feasible these will be presented.

Before words can collectively convey connected thought, their meaning has to be known. It is therefore important, more especially for the student or beginner, that the words in which Lighting Methods will be expressed, be properly defined, that the articles be fully understood. These will be published as rapidly as space will permit.

Correspondence is solicited from the readers of this department on any matters upon which they wish to elaborate or about those which may not be fully understood.

Our first article, "Decorative Periods Applied to Lighting Fixture Design" will indicate to the reader that it is our purpose to discuss Lighting Methods as completely as possible.

The artistic should not be subordinated to efficiency, but effectiveness—the proper adjustment of means to the end sought—should be the first consideration.

NOTEWORTHY LIGHTING EXHIBIT.

A miniature exhibit of lighting methods was shown by the Illuminating Engineering Society, at the International Exposition of Safety and Sanitation, held in the Grand Central Palace, New York, December 11 to 20, 1913, which was considered of such merit that it was awarded a grand prize.

The exhibit was remarkable and unique, and attracted the attention of mill owners and employees, school authorities and students, as well as architects, engineers, decorators and others interested in lighting methods.

Briefly, the exhibit presented striking examples of both good and bad lighting in the home, the school, store, mill, public conveyance, etc., and, in fact, covered almost every class of installation.

It was an excellent example of how some of the ordinarily dry-as dust facts of science may be made both interesting and instructive to non-technical people. Many thousands of those who were fortunate enough to see the exhibit were manifestly filled with wonder and surprise. They had known, of course, that light, particularly artificial light, is one of their immediate necessities; but just how much a common every-day thing may in numerous ways affect their health and happiness, few had better than a vague idea. That it may be employed to prevent a large number of industrial accidents, and to promote industrial efficiency, that it may effect strange and sometimes comic distortions of statuary and other objects of interiors—these, not to mention a host of other possibilities, were probably known to fewer still. Side by side in booths were models and pictures of good and bad lighting. Comparative conditions were clearly exposed. Uses and misuses of light, with their attending good or bad results, were indicated in ways which were at once striking and impressive. So apparent were the advantages and superiority of good lighting that one might have wondered why so many examples of bad illumination could be found. The latter fact is all the more curious when it is learned that good lighting may be had in many cases at a cost not much, if any greater than that paid for the poor illumination—in not a few instances it could be obtained for even less. It seemed evident that lighting may be good, bad, or otherwise, depending largely upon the care and skill with which it is planned.

The entire exhibit was installed under the direction of a special committee of the Illuminating Engineering Society, which gave considerable study and undertook quite a lot of experimentation that the exhibit planned would be most complete and successful. It was considered of such merit that it is to be placed in the American Museum of Safety, 29 West Thirty-ninth street, New York, where it may be seen free by the public.

DECORATIVE PERIODS APPLIED TO LIGHTING FIXTURE DESIGN.

BY F. N. COOLEY.

(In ths article, which is also an appeal for correctness in fixture design, the author describes the various periods thus far utilized and the historical associations of each. Mr. Cooley is fixture specialist with the Western Electric Company, San Francisco. —The Editors.)

To the casual observer, the detail, which is sometimes very carefully worked out in the design of lighting fixtures, is not always understood or appreciated. The fixture itself may be composed of very fancy curved arms, ornate but meaningless cast scrolls and ornamentation and still attract the average person's eye. But to the keen eye of the designer or architect, or a person who has made a study of decorative periods, each leafed ornament, cast canopy, extension or scroll, should bring out some distinct meaning.

Space will not permit of a thorough review of all the various periods of decoration which are recognized by the architects and decorators and such a review, while interesting from the artists' or historians' view point, would be superfluous in this article as but a small percentage of the many interesting periods are represented in the design of lighting fixtures.

We cannot go too far back however, by commencing with the Grecian ornaments. Evidence of this style is commonly used in the cast mouldings on body bands, break ornaments and canopy extensions. Our fixture industry would be in a sad plight if we could not bring into frequent use the egg and dart moulding effect. This ornament was originated in the fifth century, B. C., and used with most success in the Erechtheion, which is considered the most beautiful monument of Grecian art.

It was during this period that the Doric, Ionic and Corinthian designs originated, so much in use now by our architects. The Grecian period was divided into four epochs. First, the mythical period, sometimes termed the Heroic Epoch, which terminated about 1104 B. C.; second, the Doric or Archean period, from 1104 to 470 B. C.; third, the Ionic period from 470 to 338 B. C., and, fourth, the Hellenic period, from 338 to 146 B. C.

In Italy the Romans were dissatisfied with the simplicity of the Grecian designs and new designs sprung into existence there, called the Roman ornaments. These designs however, embodied, for the most part, Grecian ornaments but were greatly elaborated. Roman and Grecian designs became the standard of art and continued in prominence for many centuries.

In the 14th century the religious mysticism then prevailing found expression in a new design called the Gothic ornament. These ornaments were always expressions of harmony and are used for the greater part in the designing of our churches. The most significant emblem of the Gothic designs is the Gothic Arch.

During the 15th century, about 1420 A. D., a great change in the social conditions occurred in Italy which consequently effected religion, science and art. This universal re-birth was called in Italy the Rinascimento and by the French Renaissance.

Designs of this period at first greatly resembled the Gothic ornament which had had such full sway, but as the years passed these designs grew more and more individual and gradually spread all over Europe. France was the first to adopt these new ornaments and while the Gothic was slowly displaced by the new art, it took many years before it actually held full sway. This period is generally spoken of as the Renaissance period and is generally connected with the particular country affected, such as Italian Renaissance and French Renaissance and is divided generally into two epochs—early Renaissance 1500 to 1550 and high Renaissance 1550 to 1643.

The Renaissance period in Germany dates from about 1525 to 1620, as this country was very slow to adopt the radical changes from Gothic to the Renaissance designs prevailing in Italy and France. The oldest example of German Renaissance however, dates back to 1492, when the portal of the Castle of Mahrisch-Trubau was erected.

The Renaissance period prevailed in the Netherlands between the years of 1520 and 1621, but this class of art never reached the same height in perfection as did the Gothic designs.

Renaissance ornamentation gradually succumbed to a new and more elaboarte decoration called Barocco ornament and during the later Renaissance or Barocco periods the craze for more elaboration finally produced what is known as the Rococo design.

The Barocco period prevailed in most of the European countries during the 17th century and was known in France as Louis XIV style.

Barocco and Rococo design are in great evidence in the design of our modern lighting fixtures. Considerable criticism is due however, to uninformed designers who make use of various casting patterns and pressed leaf stampings without due regard of their relations to each other or to the general period they are trying to emphasize. An instance of this promiscuous use of ornamentation reminds the writer of a prominently placed chandelier on which were counted six representations of distinct influences. There is an old saying that "what the people don't know won't hurt them," but to the architect or interior decorator, these makeshifts of art are irritating and it is the architects and decorators who pass on the fixture design, especially if some particular period is to be represented. On the other hand there are manufacturers of lighting fixtures who appreciate the importance of correct design and employ designers who are well informed on decorative periods. The designing of a fixture is the first step in its creation and should receive the consideration it merits. The balance of its creation, while of importance, is purely mechanical.

During the years of 1720 and 1755 the Rococco decoration, as it was called in Germany and Louis XV style in France, was under full sway, and it is safe to say that few other decorative ornaments have been so widely used in fixture designing. In France the Louis XV ornament lost all semblance to symmetry, so strong was the demand for elaboration of leaved effect.

The Rococo or Louis XV designs dissolve the lines in free curves not bound with each other, under strict avoidance of symmetry.

This style was rarely used in Italy or the Netherlands but a style in England which was very popular at this time closely resembles it called Chippendale style named after Thomas Chippendale.

During the middle of the 18th century interest began to lapse in the flourishes and unsymmetry of the Rococo design and the work of substituting classic quiet and simplicity began. As the second Renaissance took place during the reign of Louis XVI this style was called, in France Louis XVI style, but was destroyed later, during the French revolution as was everything else that reminded the people of monarchy. Louis XVI designs were replaced by the Empire designs which are used extensively at the present time in the designing of our lighting fixtures. These designs embody mostly festoons of leaves and flowers and the wreath tied at the bottom or top with a bow of ribbon. This last ornament has been used unceasingly in the design of gas keys and finial ornaments.

The Empire ornaments were used in most of the European countries during the end of the 18th century and were admired in art circles mostly for their elegant and purely classic architectural form.

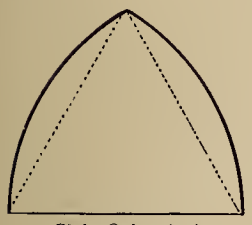
While all these famous decorative styles were being created and subsequently discarded in the European countries, a new country was being borne on the American continent. Naturally the United States at this time contained a representative class of artists and it will be easily understood that art styles were intimate with the designs predominating in the original country of the artist, but after a time all these different styles became united with one another forming themselves into the so-called Colonial style.

The old colonial buildings erected in New England states in 1725 to 1775, correspond somewhat to the Queen Anne and King George styles in England, and notwithstanding the European characteristics which they contain, the artistic creations of the 18th century in America possess certain national traits of their own.

We find among the Colonial designs, ornaments in hexagon and octagon patterns and as candles were extensively used in these pioneer days, the modern colonial lighting fixtures are equipped with imitation porcelain or enameled metal candles with frosted candelabra lamps to imitate the flame.

The relationship of Colonial designs can of course be traced directly to England and other countries and in fact there apparently is nothing strictly original in decoration, as the ornaments of each successive period obtain their origin from the period directly previous. However, additions and elaborations being added from time to time gradually change the lines until the resemblance of a few centuries before is lost.

We find in the Colonial design, a beading, commonly known as Colonial bead, which was used in Grecian architecture several centuries B. C., and the crystal pendant, the use of which is traced back as far as the 17th century.



Plain Ogive Arch (Gothic)



Bracket Candle Stick Town Hall of Augsburg



Acanthus Leaf in Barocco Style



Louis XV or Rococo Ornament



A Colonial Design

Colonial styles embody in the most part long sweeping but symmetrical curves. These lines are emphasized in the designing of spun or turned spindles for use on arms or pendants in shower fixtures while a lack of elaborate castings or scrolls is also noticeable in Colonial effects.

When Florida and the western country became settled and larger buildings erected, the inclination was naturally to resort to the Spanish Renaissance, and we still see plenty of evidence of this class of architecture in our California Missions and even in the newer buildings on the old Spanish Mission type. These styles, however, are strongly of the Gothic influences.

Since the lighting fixture industry is practically new and owing to the many methods of support of the lamp itself, no set of rules could be laid down which would guide the designer to correct period lines. The fixture designer must therefore be a good copyist, and an originator only in his methods of applying his copied patterns into his creation of the lighting fixture.

The importance of lighting glassware, properly designed to harmonize with the fixture both as regards period and correct usage, is now more than ever engaging the attention of architects and decorators, and new designs of lighting glassware adaptable to all purposes are daily appearing on the market to meet their requirements. This is but one more indication of the appreciation of architects and interior decorators of the value of correct lighting methods.

WASTE DUE TO NON-USE OF WATER POWER

BY W. V. N. POWELSON.

(This article, which is an analysis of the question of conservation of our natural resources, presents a convincing statement of the necessity for immediate development of water power now under Federal control. It is abstracted from United States Senate Document No. 243, which was presented by Mr. Shafroth.—The Editors.)

The time has come when, to preserve our character as friends of conservation, we must bring about the prompt development of those water power sites for which a market exists or can now be created.

Heretofore, because of our lack of knowledge of the subject, it did not seem good strategy in the fight for control of the water power sites in the public interest to move quickly toward their development. We needed time for study, reflection and counsel. It seemed imperative and sufficient that we employ all our resources to prevent private parties from acquiring the sites belonging to the public until a wise and constructive legislative plan for development could be devised.

While true conservation of our natural resources requires that our water power sites be promptly developed, true statesmanship requires that the development shall be made in harmony with the public interest.

A little reflection will show that it is possible that the evil of non-development, if continued long enough, may exceed the evil of unwise development.

The true interest of the public lies now between these two extremes. We can not remain in our present situation with a practical embargo on the development of sites now controlled by the government without important losses; nor can we without danger permit the development of these sites unless we retain an efficient governmental control over them after development.

As illustrating the extent of the Federal control of water power sites, I may say that it extends to every stream declared navigable, and to all sites on lands yet owned in fee by the government. That the amount of such land, particularly in mountainous sections, where the best sites are as a rule found, is enormous is shown by the data of the following table, which indicates certain states in which the area of Federal land exceeds 50 per cent of the total area of the states, and it is in these states and on these lands that the principal undeveloped water powers of the country are to be found.

Table Showing Approximately the Percentage of the Area of the Arid States Owned by the Federal Government.

State.	Total acreage owned by United States.	Percentage of total.
Arizona	67,097,293	92.00
California	53,276,547	52.58
Colorado	37,702,033	56.67
Idaho	45,218,919	83.80
Montana	61,049,263	65.80
Nevada	62,219,423	87.82
New Mexico	49,315,409	62.83
Oregon	32,229,745	51.90
Utah	43,564,645	80.18
Washington	17,684,198	40.00
Wyoming	42,613,499	68.00

Up to this time it has seemed the part of wisdom to counsel delay in dealing with a matter so important and so intricate. So far it has seemed the part of good strategy to throw away one thing of value to gain another which promised to be of greater value. But the process of throwing away the thing of value is still going on, and every day adds to its sum total.

We must not continue to throw away until we exceed the value of the thing we are striving for.

We have had ample opportunity during the past three years for reflection, study, and the preparation of our plans, and the people are now looking to the leaders of the conservation movement to come forward with a practical scheme of legislation that will bring about the speedy development of needed powers under an efficient public control and thus definitely put a stop to the enormous waste involved in the non-development of these powers.

Through the efforts mainly of Mr. Gifford Pinchot sensible men have come to recognize that there must be an efficient governmental control over these sites after development. There still exist differences of opinion as to details of this control, but the public interest requires that these differences be composed without further delay. What these differences seem to me to be I will describe later, after having first pointed out the tremendous waste of our natural resources involved in the continuance of economical available water power sites in an undeveloped state.

Waste by Non-Development.

The same amount of work is being done at a water power site whether it is undeveloped or developed. In the one case the work is mainly expended in agitating the water; in the other, in serving useful purposes. All over the country, wherever water runs, work is being performed, but at only comparatively few such places is this work being turned to useful purposes. While we are arguing about the details of a conceded public control, vast quantities of work are being thrown away which we might have in useful form for the harnessing. Once properly harnessed the work will have been permanently changed into a useful form and it then becomes a national asset of great value, which will forever provide useful employment for men.

Every undeveloped water power site for which a market exists, or could now be created, is a willful waste of a natural resource. If we do not make present use of the falling water of a stream, the useful work it is capable of doing is lost forever, and there is a waste of a natural resource. If, however, we do not make present use of coal in the ground, it will remain there in undiminished quantity and quality; we can at any future time convert it into useful work, and there is no waste of a natural resource.

It is just as wasteful of our natural resources to burn coal to do work that could as well be done by an undeveloped water power as it would be to permit an equal amount of coal to burn up underground. We see, therefore, that upon the sum total of our power resources the effect of an undeveloped water power in a locality where it could do work now being performed by coal is precisely as destructive in character as a coal deposit burning underground.

By a strange fatality many people have jumped to the conclusion that it is a conservation of our natural resources to keep our water power sites in their natural condition.

Because such a policy if applied to a coal field would be a policy of conservation, it does not follow that it retains this character when applied to water power sites. In fact, quite the contrary is true. A policy which in its practical effect results in non-development of our water power sites is not a policy of conservation at all, and its continuance can only be justified by a clear demonstration that the evil of this policy is less than the evil of any other policy that could be substituted for it.

For each (hydraulic) horsepower economically available for development there is now being substituted and burned 5½ tons of coal per year. This is based on a 12 hour day. At $2 per ton this is equivalent to a waste at the rate of $11 per year for each undeveloped horsepower now economically available for development.

Assuming that five million horsepower is undeveloped that can now be profitably developed, the non-development of this power represents an absolute waste today at the rate of 27,500,000 tons of coal per annum.

If the entire 32,000,000 minimum potential horsepower, as conservatively estimated, were developed, the total saving of coal would be about 175,000,000 tons per annum. It may be of interest to know that our present consumption of coal for all purposes is about 500,000,000 tons per annum, of which about 90 per cent is for industrial purposes. The average price of coal is probably in excess of $2 a ton, so that a measure of the present value of this waste would probably exceed $55,000,000 per annum.

Does not the possibility here presented of increasing the saving from 27,500,000 tons per annum to as near 175,000,000 tons as practicable present a field for fruitful endeavor on the part of the government? Does not the possibility of so tremendous a saving of our natural resources suggest that the attitude of the government should be at least sympathetic and not repressive? Does it not even suggest that the public welfare may soon require the principle of a bounty to encourage the development of its powers?

As against these tremendous losses to the nation, due solely to delay, what have we gained by the delay? What did we hope to gain by delay?

We have caused to be universally accepted the principle of an efficient government control, and we have preserved to the Federal Government the potential opportunity to collect a rental for the use of its water power sites.

I use the word "potential" because if the rental fixed is more than the traffic will bear at a particular site the development will not be made and no rental will be collected from it.

The most important and the important thing we have gained is universal recognition of the principle of an efficient governmental control.

It is probably not of vital consequence to the public welfare whether this control be exercised by representatives of the Federal or the state government. The important thing is that the control should be efficient and fair and in harmony with the public welfare.

Of far less consequence, to my mind, is the preservation to the Federal government of the "potential" opportunity to collect a rental from a site for the benefit of the public treasury, because I doubt the expediency of an attempt in this form to distribute to the people their fair share of the values flowing from the development of their sites.

Water powers, like city real estate, exhibit enormous differences in earning capacity. Many water powers have little or no commercial earning capacity in competition with coal. It would require in many cases a bounty to bring about their development. If we charge a rental on all water power sites at a uniform rate per horsepower of available capacity, only those sites will be developed that can stand the rental. Other sites that might have been developed under a smaller rental or under no rental at all will lie idle and valuable supplies of coal will be consumed to do their work. Is it not true that what we might collect for the people as a rental from a dozen developed water powers could easily be lost to the nation from the waste involved in a single undeveloped power whose development was prevented by the rental policy?

Fundamentally the question of a rental collected for the benefit of the public treasury is not a question of conservation at all. It is a social question contemplating an equitable division of potential profits, essentially the same as other social questions that have been correctly solved by governmental supervision and control of the service contracts and profits of public service corporations. No new form of wealth is created by the imposition and collection of such a rental or tax, and therefore each year we permit coal to be used to do work that can as economically be performed by water power we, as a nation, are being impoverished by the value of the coal so used, now estimated at about $55,000,000 per annum.

While I am in entire sympathy with the purpose of the rental charge, I must confess that, in my opinion, unless it be based in each particular case either on actual profits earned or on an agreed estimate of prospective profits prepared in each particular case as the result of a most skillful and exhaustive investigation, the rental policy, if applied generally, may do much more harm to the public welfare than good. But in suggesting that the rental policy may be impracticable, I am not suggesting any abandonment of the purposes for which that policy was suggested. Excessive profits, if earned, must be returned to the people, but it appears to me fundamental that an excessive profit must have been actually earned before a division is due, and the extent of the division must be controlled by the amount of the profit.

I admire the courage of the men who have prevented the development of our water power sites, their patriotism, their high purpose. I am not one of those who would impugn the motives of these men if they should now insist that these sites be continued a while longer in their natural condition. I would understand that they believed this policy necessary to the public welfare, but I would question their judgment.

I do not remember having heard it suggested in any quarter that the proposed rental should exceed around $1 per year per horsepower of site capacity,

and the fear has been expressed in some quarters that a charge exceeding 50 cents per horsepower might retard, if not prevent, the development of many otherwise economically available powers.

It may not be out of place to say here while considering the amount of the rental that water powers may be divided into three general classes. First, those capable of producing power considerably cheaper than by coal. The number of powers in this class is not very great. In the second class the saving over coal is small, and the margin of saving may be so small that mistakes in the estimate of cost or unusually adverse conditions during construction might easily make the difference between a success and a failure of the enterprise. In this class there are a very large number of powers. But the largest class of all consists of those powers that are not now economically available as competitors of coal.

Assuming that the traffic would bear an annual rental of $1 per horsepower of site capacity for the several million horsepower now, in the judgment of Mr. Herbert Knox Smith, economically available, then the largest sum which it has been suggested we gather into the public treasury from every undeveloped water power in the country, now economically available, is but $5,000,000 per annum, if by several million horsepower Mr. Smith means 5,000,000 horsepower. Let us assume for the purposes of discussion that the imposition of this rental or tax does create new wealth for the nation to the extent collected. How does this potential gain compensate for our losses, actual in the past and present, prospective in the future?

The losses which we are now suffering through waste of our natural resources—estimated at $55,000,000 per annum, or $11 per horsepower per annum—is the equivalent at 5 per cent of an annual sum in perpetuity equal to 55 cents per horsepower per annum on the whole 5,000,000 of economically available horsepower.

A delay of two years, therefore, represents a loss equivalent to an annual sum in perpetuity of more than $1 per horsepower on the whole 5,000,000 horsepower. A delay of three years, which I think it may be conceded we have experienced, has probably cost us the equivalent of a sum in perpetuity at the rate of $1.50 per year per horsepower on the whole 5,000,000 undeveloped horsepower.

A superficial view of the question might suggest that the country could recoup these past losses by charging a rental of $1.50 per horsepower per year and make a profit by charging a higher rental, but no country can enrich itself or recoup past losses by a tax, because a tax merely changes the ownership of a part of the wealth of the nation. We can never recoup for the nation the losses that have already been incurred, and it is our imperative duty to bend all our efforts to stop further waste.

I think it should be conceded that there would be considerable competition between the different groups skilled in water power development in this country and abroad if the opportunity were offered to develop those sites now controlled by the Federal government and that are economically available, and therefore it seems to me the part of wisdom for those having the public welfare at heart to ascertain at the earliest practicable moment the terms, the best under which responsible capital will come forward in competition to develop our powers, and, unless the acceptance of these terms will be more harmful to the public welfare than the continuance of our water powers in an undeveloped state, these terms should be accepted, and all parties should join in securing the legislation necessary to bring about the developments forthwith.

So far as I know, investors are not dissatisfied with the attitude toward capital as far as it pertains to the rate of return. No one is opposed to investors receiving a fair, even a liberal, return on their money devoted to water power development. While there are decided differences of opinion as to whether the governmental control should be Federal or state, the water power investor as a rule does not care which it is, provided it is not both at the same time. He insists that he serve but one master.

It is feared that if the control is dual a conflict might arise between the state and Federal authorities which would result in injury to the investor. There is a feeling, however, that because the state has an inalienable right to regulate public utility corporations doing business within its boundaries the Federal government should relinquish to the state its right to exercise a control, provided that the developing agent takes the form of a duly incorporated public service corporation, subject to and recognizing the state's right to supervise and control its acts. Since its revenue would be derived almost wholly from the sale of its power for public uses, it would not be a difficult matter to determine what its actual profits are, and the state, through its power to regulate, would always be in a position to place a reasonable limit upon those profits by reduction of prices, by taxation, or by both.

While there does not seem to be, other than the desire to eliminate a dual control, any marked preference on the part of the water power investors for Federal or state control, there does seem to exist a very marked preference for a Federal control on the part of those who have been heretofore most active in the conservation movement.

As I understand the matter, their preference for Federal control springs from a distrust of the state's machinery for control. They understand the advantage to any community accruing from the expenditure in it of very large sums of money on construction work, with the prospect of added population and employment after the power development has been made. They fear that if two states containing water power sites become active competitors for the expenditure of money in hydroelectric development capital might obtain concessions which would limit the opportunities of the people to participate to the extent they ought in the values created by the development. In other words, if I correctly understand their position, they regard the people of the general section in which the development is to be made as incapacitated through self-interest to look after the welfare of those to come after, and they desire that the Federal government shall exercise a guardianship over the future of the state, because they believe the Federal government to be free from the evil influences of self-interest.

A strong preference in favor of control by the

state is held by those who are citizens of the state and who believe that in the long run control by the state will be more truly responsive to the legitimate needs of both the people and the power companies. They point out that the uses to which these water powers will be put in the different parts of the country and the conditions surrounding these uses will be so different that it is doubtful whether a controlling body at long distance from the place of use can be made to understand and properly administer to the needs of the particular locality.

[To be continued.]

WHAT CONSTITUTES BENEFICIAL USE OF WATER IN IRRIGATION.

Under the laws of water rights as established by legislation and court decrees in the arid states of the West, the final test of a right to water for irrigation is that the water claimed shall be put to a beneficial use. As expressed by the laws of several states, "beneficial use is the basis, the measure, and the limit" of rights to water. These laws, however, do not attempt to define "beneficial use."

At a conference of the project managers of the U. S. Reclamation Service and representatives of the Department of Agriculture, held at Salt Lake, November 12-15, a resolution attempting such a definition was adopted. This definition is somewhat long and detailed, but in substance is as follows:

A water user is entitled to that "amount of water that will render him a reasonable maximum amount of good with a reasonable economic handling of the water." He is entitled to the protection of the state in this right, but, in return the state has a right to demand that he use reasonable care and judgment in conveying and using water and cultivating his crops.

The conference adopted also a definition of "economical use," which was in substance as follows:

Since the water supply available for irrigation in the Western states is adequate for only a relatively small percentage of the entire irrigable acreage, the fundamental standard of economical use must be the financial results accomplished per acre-foot of water applied, rather than the yield per acre irrigated. In future development the doctrine of beneficial use must in many cases merge into or be supplanted by that of economic use. The doctrine of beneficial use looks to individual interest: that of economic use to the general welfare of society as a whole. So far as possible, water charges, systems of distribution, and regulations should be so adjusted as to make the interest of the individual water user coincide with this public interest.

Customers Department is the satisfactory solution found by the Toledo Railways and Light Company to the problem of determining what name is best for that department which comes into direct contact with the consumer. Light and Power Department is popular usage in the West together with Contract Department which is also extensively used in the east. The name, Customers Department, is perhaps the most satisfactory yet used. It is easily understandable and is suggestive of a considerateness which inspires confidence.

WATTMETER READINGS AND POWER FACTOR OF BALANCED THREE-PHASE CIRCUITS.

BY A. R. HAYNES.

(The author appreciating fully the article on this subject which appeared in the November 29, 1913, issue of this journal, and realizing the practical value of this information, contributes from his notebook a viewpoint of this same subject from a different angle. The curve, Fig. 4, is in use at the General Electric Company's Testing Department and Laboratories. Mr. Haynes is chief operator, White River Station, Puget Sound Traction, Light & Power Company.—The Editors.)

The method of measuring power in three phase circuits by means of two single phase wattmeters or watthour meters is in general use and well understood, but the fact that the power factor may also be easily and accurately determined from these same readings or in the case of the watthour meters from the number of revolutions in a given time, when the circuit is balanced, is little known outside of testing laboratories. The peculiar behavior of one of the meters—reading sometimes positive, negative or zero; or in the case of watthour meters the disk running forwards, backwards or stopped—depends entirely upon the power factor of the circuit. The proofs and curves for obtaining the power factor of any balanced three phase circuit follow:

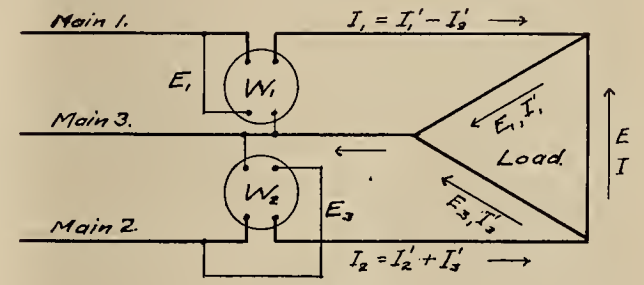


Fig. 1

Fig. 1 shows the ordinary connections of two single phase wattmeters for measuring the power of a three phase circuit. The current coils are in series with the mains and the potential coils are connected across to the third main. The arrows showing the assumed current and voltage directions have been so taken that both meters will read positive for delivered power.

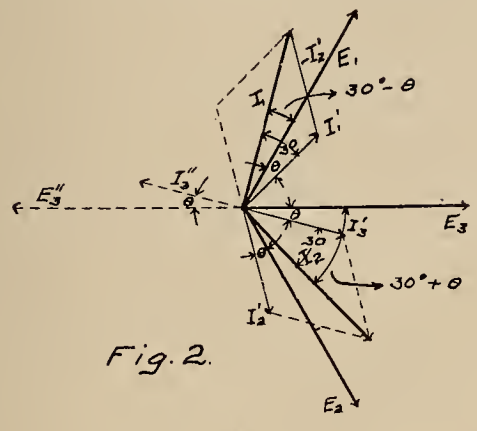


Fig. 2.

Fig. 2 is the corresponding clock diagram. It will be noted that the vectors, E_3 and I'_3 are reversed

as they were so taken in the delta load mesh of Fig. 1. Assuming a balanced load, E_1, E_2 and E_3; and I'_1, I'_2 and I'_3, are equal, respectively, hence the vectors, I_1 and I_2 make angles of 30° with I'_1 and I'_3. Let the angle of lag be θ. With a balanced load this will be the same for all three phases; consequently, the phase difference of E_1 and I_1 is $30° - \theta$; and that of E_3 and I_2 is $30° + \theta$. Hence the power measured by W_1 is

$$W_1 = E_1 I_1 \cos (30° - \theta) \text{ or } E_1 I_1 \cos (\theta - 30°) \ldots . (1)$$

and by W_2,

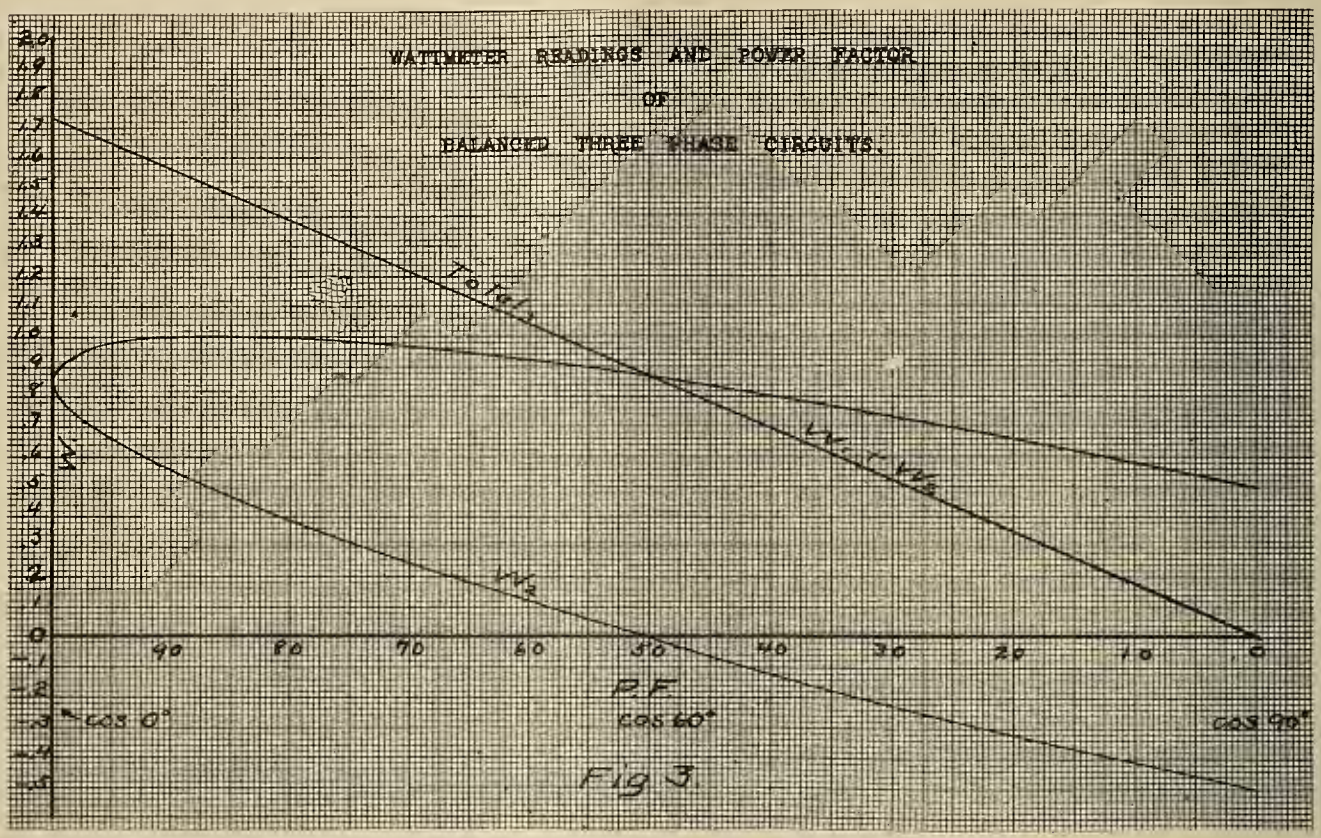


Fig 3.

$$W_2 = E_3 I_2 \cos (\theta + 30°) \ldots . (2)$$

These equations are plotted, assuming unity values of current and voltage in Fig. 3 with cos θ or power factor as abscissa. It will be noted that the behavior of W_2 now becomes clear. It decreases in value with the power factor becoming zero at 50per cent P.F. where θ is 60°, and thereafter negative for larger values of θ. With a non-inductive load or unity P. F., the meter readings are equal and their sum indicates the delivered power; at 50 per cent P. F., one is zero and the other shows the power; while at zero P. F. the readings are equal and opposite and the entire power is reactive.

The power factor and corresponding phase angle may be obtained from equations (1) and (2) as follows:

By composition and division,

$$\frac{W_1 - W_2}{W_1 + W_2} = \frac{E_1 I_1 \cos (\theta - 30°) - E_3 I_2 \cos (\theta + 30°)}{E_1 I_1 \cos (\theta - 30°) + E_3 I_2 \cos (\theta + 30°)}$$

Since the circuit is balanced, the E's and I's cancel and we may apply the formulae,

$$\frac{W_1 - W_2}{W_1 + W_2} = \frac{2 \sin \theta \sin 30°}{2 \cos \theta \cos 30°} = \tan \theta \tan 30°$$

or $\sqrt{3} \tan \theta$; from which,

$$\text{P. F.} = \cos \text{ arc tan } \sqrt{3}. (W_1 - W_2)/(W_1 + W_2) \ldots (3)$$

Numerical values may be obtained with greater facilitiy, however, by starting again with equations (1) and (2). Using the formulae,

$$\cos (A + B) = \cos A. \cos B + \sin A. \sin B$$

we have,

$$\cos (A - B) - \cos (A + B) = 2 \sin A \sin B$$

and

$$\cos (A - B) + \cos (A + B) = 2 \cos A \cos B$$

Whence,

$$\frac{W_2}{W_1} = \frac{\cos \theta. \cos 30° - \sin \theta. \sin 30°}{\cos \theta. \cos 30° + \sin \theta. \sin 30°}$$

Now $\cos 30° = \sqrt{3}/2$ and $\sin 30° = 1/2$.

Substituting,

$$\frac{W_2}{W_1} = \frac{\sqrt{3}/2. \cos \theta - 1/2. \sin \theta}{\sqrt{3}/2. \cos \theta + 1/2. \sin \theta}$$

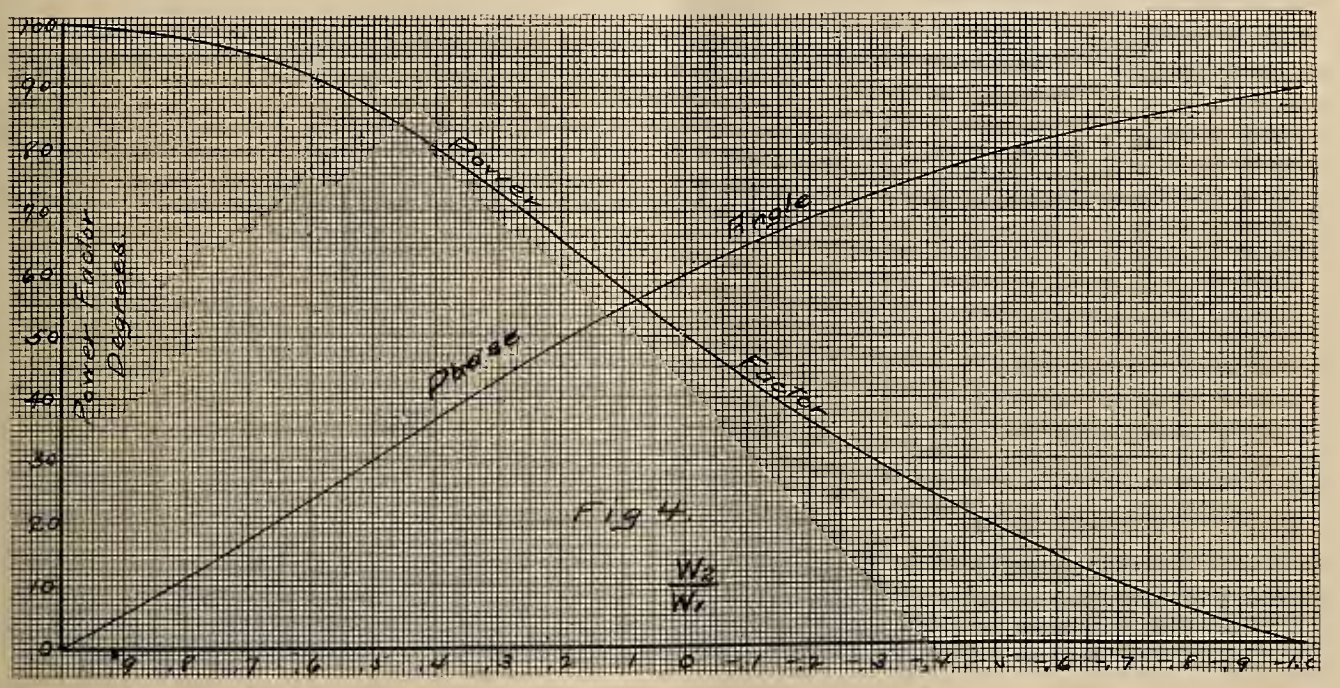
Dividing both numerator and denominator by 1/2. cos θ,

$$\frac{W_2}{W_1} = \frac{\sqrt{3} - \tan\theta}{\sqrt{3} + \tan\theta} \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

From Fig. 3 it is plain that the value (4) passes from + 1 to — 1 as the power factor varies. Therefore if values of (4) be assigned between these limits, corresponding values of θ may be determined. Placing (4) equal to x and solving for tan θ,

$$\tan\theta = \sqrt{3}.\ (1 - x)/(1 + x)$$

Whence,



$$\cos\theta = \frac{1 + x}{2.\sqrt{1 - x + x^2}},$$ which gives values

of the power factor directly, and wherein the assumed values of x may readily be substituted. The curve of Fig. 4 was derived in this manner. It gives the power factor corresponding to any value of W_2/W_1, which may be easily obtained by the slide rule from any given set of readings. The value of θ may be read off at the same from the "Phase Angle" curve should it also be desired.

When two single phase wattmeters are wired up on a circuit of unknown or varying power factor, the sign of the reading of W_2 may be in doubt. For example, an induction motor driven machine: In this case, if there is any way of loading the machine while the behavior of W_2 may be observed, the right connection may readily be seen. When load is thrown on the motor the power factor will rise, and hence if the reading of W_2 increases with the load, the power factor is known to be above 50 per cent. (See Fig. 3.) The same reasoning applies to polyphase integrating watthour meters. In this case the two elements should be tried separately to see which disk revolves the slowest—W_2. Having found W_2, the speed of revolution as load is thrown on can be noted and if it slows down the potential connection of this element should be reversed.

The curves of Figs. 3 and 4 readily afford a test of the balance of a three phase load. Let W'_1 and W'_2 be the readings of the single phase meters— (or number of revolutions of the watthour disks in a given interval)—and let W'_1 be the larger. If the circuit is balanced the value of $W'_2/(W'_1 + W'_2)$ (this test fails at 50 per cent P. F. as W_2 becomes 0) should equal $W_2/(W_1 + W_2)$ where W_1 and W_2 are the values found from Fig. 3 for the "apparent" power factor as determined from W'_2/W'_1 in Fig. 4. Where the difference is marked, the value of the power factor as obtained from Fig. 4 will be in error as these curves are based on balanced conditions. Unless the difference is rather large, a value close enough for most purposes will be obtained.

Should greater accuracy be desired, readings might be taken using each main as a neutral in succession and the power factors as obtained from each set of readings averaged. But on unbalanced load the true power factor is difficult to determine accurately, though the true power is easily and accurately obtained, allowing for instrument and personal errors.

ALASKA'S COAL DEVELOPMENT.

According to a statement in a report on the mineral resources of the United States issued by the United States Geological Survey, has been held back on account of the lack of legislation permitting the exploitation of the known extensive and valuable fields. In 1912 the commercial product of coal in Alaska amounted to only 355 tons. In addition 900 tons were mined under the direction of the Bureau of Mines for testing by the United States Navy. The imports of coal into Alaska amount to about 100,000 tons annually, but most of the transportation and manufacturing industries of the territory now depend on California oil for their fuel.

DIESEL ENGINE INSTALLATIONS ON BOARD SHIPS.

BY LARS JORGENSEN.

While the principles of the Diesel engine were invented more than ten years ago, the commercial success of this type of prime mover has but very recently been demonstrated. Judging from the rapidity with which the latest developments have taken place, this type of engine bids fair to supersede the steam engine on board ships—at least on ships running on certain routes.

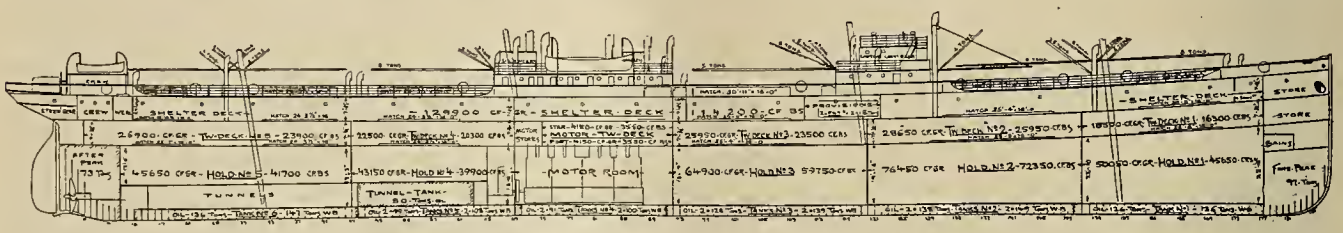
As the Diesel engine has of late been able to show a marked superiority in economy over any form of steam driven engines, there is no reason why this type should not come to the front. Its construction, although more complicated than a turbine, is simple enough to insure reliability. In a Diesel engine many troubles inherent in the ordinary gas or gasoline engine are entirely eliminated. Only plain atmospheric air takes part in the compression, not a mixture of air and oil, as in the ordinary gasoline engine. Therefore, backfiring and premature explosion, which are the main causes of uncertainties in the operation of the gas or gasoline engine, making them more or less unfit say for use in a stand-by plant of an electric power system, cannot take place. The Diesel engine would therefore, seem to be especially well adapted and is in use in many medium size installations in Europe. It is always ready for work at a moment's notice, no boilers have to be kept under fire. It has a two and one-half to a three times higher fuel economy than the steam turbine.

The performance taking place in the cylinder of a Diesel engine is briefly as follows: Pure atmospheric air is drawn into the cylinder and compressed during the return stroke, not to say, 150 lb. per sq. in. as is used in ordinary gas engine practice, but to about 500 lb. per sq. in. At this pressure the air has a temperature of nearly 1000 degrees F., which temperature is high enough to ignite the finely atomized spray of crude oil being forced into the clearance space of the cylinder at the end of the compression stroke. This injection of oil is kept on until about 1/9 of the working stroke has been completed, during which time a rapid combustion (not explosion) takes place in such a way that the initial pressure of 500 lb. per sq. in. is kept fairly constant until the inlet valve closes at 1/9 the stroke and the expansion commences.

The high compression of 500 lb. per sq. in. stimulates the combustion and the high efficiency obtainable with a Diesel engine is in a large degree due to this fact. The use of the high compression does away with all igniting devices, carburetors, etc., thus adding greatly to the reliability of the engine.

The development of the Diesel engine has been most active in Europe, both for marine and stationary purposes. There are several hundred thousand horsepower installed in electric power plants and on ships and over 300 of the latter are either now afloat or under construction. The "Selandia," the largest ship so equipped at that time, made its first trip between Copenhagen and Siam, 1½ years ago. It belongs to the Danish East Asiatic Steamship Company of Copenhagen, and a description of a few features of its power installation and its operation will be of interest.

The "Selandia" is a freight steamer of 7400 ton carrying capacity; it is equipped with two propellers, each driven by a Diesel engine capable of delivering 1200 h.p. to the shaft. The normal output, however, is only 1000 h.p. at 140 r.p.m., as this is sufficient to give the ship a speed of between 11 and 12 knots per hour, which speed is found most economical under the circumstances. Each engine is provided with 8 cylinders, working on the 4 cycle principle explained above, which gives two working cylinders per propeller at any one time. The cam shaft for operating the outlet and inlet valves has twice the number of cams ordinarily used, one set being used for running "ahead," and the other set for running "back." A small longitudinal movement of the cam shaft is all that is required to change the direction of rotation of engine and connected propeller. Compressed air is used for starting, the same as for all large gas engines, and when once started little attention is required. The crude oil for feeding the engines is stored away in the double bottom of the ship, a space which in ordinary steam ships cannot be put to any use. On account of the possibilities of the ship striking an obstruction some reserve is also carried in other parts. On the trip across the North Sea the engines used 10 tons of oil every 24 hr., including all auxiliaries, while a steamer under the same conditions would have used 40 tons of coal. At the West India dock in London the pilot called for 81 maneuvers of the engine inside an hour, which were answered with greatest exactness to the astonishment of several English ship builders who watched the performance of the ship.



Cross-Section of Diesel Engine Ship "Siam" now on the Pacific Coast.

An ordinary steamer running on the route between Copenhagen and Siam, coals at several places en route. It must pay higher prices as it proceeds away from England, as all the coaling stations are supplied with English coal, but the "Selandia" is able to take enough crude oil on board at Singapore, where oil is cheapest, to make one round trip. This circumstance represents another big saving, and close figuring gives the result that the Diesel engines save nearly 70 per cent of the fuel cost on this route, besides much labor expense.

Another advantage, besides the smaller fuel cost and larger space available for cargo, is the cleanliness which goes with such an installation, also that there is no boiler plant to heat up the ship and cargo, which, especially in tropical climates, is of no small moment.

The maintenance is not expected to be abnormally high for all the moving parts are as simple as a steam engine. The first cost of the engine has been high, partly due to the fact that nothing connected with it was standard and partly because all parts have been made exceptionally strong in order not to take any chances, on what was more or less an experiment. These engines were made on the 4-cycle principle, because it is the oldest and most conservative principle, although it was known that the 2-cycle principle could be usel in Diesel engine design resulting in a much cheaper engine, even considering its somewhat lower efficiency. While this ship built by Burmeister & Wain, Copenhagen, was the largest afloat 1½ years ago, it has been followed by others nearly twice as large and the ultimate size is not yet known.

The Diesel motor ship "Siam," due to arrive in San Francisco harbor on January 5th on its first trip around the world, which also belongs to the Danish East Asiatic Steamship Company of Copenhagen, is a forerunner of a line of Diesel ships which this company intends to put in regular service between ports in northern Europe and the Pacific Coast just as soon as the Panama canal is open for traffic. The "Siam" was built by Burmeister & Wain, Copenhagen, and has a freight carrying capacity of 9400 tons. The overall length is 410 ft., the width 55 ft., and the draft 27½ ft. It is provided with two eight-cylinder engines of 1600 indicated horsepower each. Each cylinder is 590 millimeter in diameter, the stroke is 800 millimeter, and the speed is normally 11½ knots.

The United Steamship Company of Copenhagen is at present building two ships of 13,000 tons freight carrying capacity each. One, the "California," is to be equipped with Diesel motors, and the other with a steam engine of equal horsepower. This is being done in order to find out in a practical way the actual economy of a Diesel motor ship compared with a steamship. The results from these tests will guide the company in deciding upon its future policy and especially as an aid in finding the economy possible in replacing steam engines with Diesel motors in existing steamships. The comparison will also prove useful in deciding upon the routes best adapted for steamers and for Diesel motor ships respectively.

Whether or not a Diesel motor will be a serious competitor to the steam turbine for the generation of electricity in large central stations remains to be seen. So far, Diesel motors have not been made in very large sizes and as far as simplicity is concerned turbines will always be ahead of a Diesel motor. A Diesel motor while much larger in volume than a turbine of the same capacity, takes up about 30 per cent less floor space than does the steam turbine, together with its necessary equipment of boilers, and generates a kilowatt-hour at a lower cost.

Some day these facts may induce large manufacturing concerns to develop a type of large size Diesel motors adapted for use in large central stations, but at the present time the single steam turbine has no competitor in this class of business.

The growing use of electricity and gas for power purposes in the oil fields is causing a gradual diminishing of the quantity of oil used in that field for fuel.

British Columbia mining dividends for the first nine months in 1913 amounted to a sum, paid out in the Kootenay and Boundary districts alone, of $1,654,875, or nearly $500,000 more than the companies in the same districts paid out during the entire year of 1912.

LIFE AND SERVICEABILITY OF METAL FLUMES.

In reply to a circular letter sent to engineers of the U. S. Reclamation Service, requesting information relative to the life and serviceability of metal flumes, the Reclamation Record publishes the following compilation of replies:

The following questions were asked:

(a) Is the galvanizing proving generally serviceable?

(b) Is there any serious rusting of the metal body?

(c) Is the use of paint desirable?

(d) Is there much difficulty in keeping the joints water-tight?

(e) What depth of clearance do you allow above the water line?

(f) Does sand seriously cut the flumes where the velocity is high?

(g) What maximum limit of velocity (ft. per sec.) in sandy or silty waters should be adopted?

Project.	Type, etc.	Age in Years.	Replies to above questions: (a)	(d)	(c)	(b)	(e)	(f)	(g)
Orland		3	Yes	No	No	Yes	6″		4
Uncomphagre[2]	Maginnis	4	Yes[3]	No[3]	No	Little	6″-12″	Yes	5
Boise		4	Yes	No	No	No[5]	2″-6″	No	5
North Platte	Hess (Am. Ingot Iron.	1-3	Yes	No	No[4]	No[6]	4″-6″	No	6-8
	Maginnis... Galvanized.	4	No	Yes	Yes	Yes	4″-6″	No	
Carlsbad	Maginnis		Yes	No	No	No	6″		
Belle Fourche	Maginnis		Yes	No	No[4]	Little	2″-3″		6
Shoshone	Maginnis	1	Yes	No	No	No			

[1] At seasons when temperature varies widely during 24 hrs.
[2] Provisional report pending better examination of flumes.
[3] Some sections have failed. Probably not general.
[4] Bolts, nuts, etc., should be painted.
[5] Temperature changes make it necessary to tighten joints each season.
[6] Not if joints are caulked with fiber cement. For riveted joints, yes.

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FOUNDED 1887 AS THE
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A Prosperous New Year

Stepping across the threshold into the immensity of the New Year, with its full measure of working days awaiting the performance of deeds, the Journal would pause, reach out and grasp your hand with the pressure of true friendliness, to wish you A Prosperous New Year. Then, urged by our common purpose—the prosperity and progress of this last great West—to press on again together.

That which constitutes your idea of prosperity is the good we have wished you, whether increased business, or whatever it may be. There is no limitation: we have wished you the realization of your own conception of prosperity, and would aid you, if possible, in attaining that end.

The outlook for 1914 is more promising. The year comes to us to encourage and finds a people receptive to its utmost intent.

A period of trial and adjustment to change is about us. The business waters, agitated and disturbed, are to have the oil of enterprise, determination, resourcefulness and proper adjustment poured upon them. The passage will again be made smooth.

With the good of all a common and desirable aim, selfish seeking should be subordinated, and such successful progress made in our endeavor that this increased prosperity will early be attained.

A Prosperous New Year.

Lighting Methods

Lighting has existed at least longer than man, but was generally haphazard, without method and uncontrolled. Even the sunlight was uncertain and the method of the moon a seeming madness. The starlight was spectacular on occasion, but save as a guide and an inspiration, knew no other value.

Seated close by a fire for warmth our forefathers found they could prolong the day, for artificial light though flickering and uncertain was the nightly accompaniment of the camp fire's heat.

The man who plucked the first brand from the fire and held it aloft, perhaps to obtain a better view of some wild animal which affrighted hurried back into the darkness, was the first to show method in lighting and away down the ages, more and more method has been introduced.

The miner making a cup of his hands so that they formed a reflector, and holding the candle low down to keep the light from his eyes was employing lighting methods—engineering illumination that more satisfactory results might be obtained. So also did our mothers' as candle or lamp in hand they shielded the light from our sleeping eyes. The same methods may be employed for entirely different results.

Our forefathers, the miner and our mothers, all illuminating engineers. Building up through observation and experience, necessity and usage, the methods which were later to form the basis of a most important science.

Method suggests the manner of accomplishment; that which has been done before and so may be done again. It does not necessarily treat of a science as such, but records the application of the principles in-

volved; the purpose accomplished. It is on such a basis that practical information may be readily imparted and it is in this manner that this new department of Journal service will be of value to our readers.

Lighting methods multiply rapidly and improve both as regards effectiveness and appearance. New installation typical of the most recent developments—the application of the latest laws, discovered by research—will if properly and promptly recorded make for progress and improvement, both as regards business and in the results obtained.

Lighting methods starts auspiciously, its growth should be interesting and rapid, and its maturity early.

Conservation by Wise Utilization

The fate of the West depends upon the battle between the spirit of achievement and the spirit of hindrance. The men who do things, those who blaze the trails of progress, are opposed by a horde of camp-followers, who would stifle all initiative and kill all ambition.

In no field has hampering legislation been more keenly felt or are its probable results more disastrous than in the development of the great hydroelectric resources of the West. Yesterday's poetic fancy that the silence of these solitudes was broken only by the dashing spray of tumbling torrents may charm the ear and please the eye, but it does not meet to-day's stern reality in feeding the mouths of the unemployed mobs in the cities that now occupy the sites of these former solitudes.

How the development of water-power reacts in developing the country is admirably told elsewhere in this issue by Frank G. Baum. The railroads have so concentrated people in cities that the problem of living in this modern world is the problem of finding room in it. This the transmission lines make possible by furnishing to the farm those advantages and conveniences which constitute the chief attraction of city life. They thus tend to reverse the direction of population flow.

We fully recognize the evils of a development which exploits the needs of the people. But we firmly believe that the Forest Service, in seeking to avoid the Charybdis of unwise development, has steered into the Scylla of non-development. Water power is not diminished by use nor conserved by non-use, as is logically proven on another page by W. V. N. Powelson. It renews itself perpetually and is wasted only when not used.

In trying to safe-guard the interests of the public the Forest Service is performing a noble duty. But can rates be reduced by virtually forcing the expenditure of an extra $75,000 to build a siphon to keep water off from government land? Is the fact that Federal property is crossed by a few feet of flume or a few acres flooded from a reservoir sufficient to justify a perpetual option for governmental purchase of a great transmission system? Do not the very stockholders of a corporation constitute an important part of the public whose interests are to be protected? Safe-guarding the interests of one part of the public by confiscating those of another is contrary to the established principle of American government.

The whole country is now suffering from the continued governmental attacks against legitimate business interests. All industry has been paralyzed by the wanton destruction of confidence in their stability. Distrust of the trusts is the reagent which has precipitated hard times from the solution of normal business conditions. Just as a horse is broken to the will of its master, so should the trusts be broken to the will of the people. But just as a high-spirited animal is worth far more than one broken in body and in spirit, so should men of spirit and ability be encouraged in their efforts which redound to the general good of society.

The Spirit of the Hive

The spirit of the hive finds its expression in co-operative service. Maeterlinck tells us in his Story of the Bee that "the bee is above all and even to a greater extent than the ant, a creature of the crowd." Isolate the bee and death results from sheer loneliness. To the bee existence without aim is also undesirable; there is a desire to fill its place, active industry and even self-sacrifice for those who may come after. In the hive the individual is nothing and existence conditional only upon present useful co-operative activity.

That the pride of toil be equally distributed is also as inherent principle of the hive, and that every achievement be anonymous and common to all. A truly "fraternal" spirit is expressed by these sisters of toil. None does all the work, but each contributes her share to the completion of the task they so willingly and industriously undertake for posterity.

It would be difficult to say why it is that the bee balances the future against the present, and perhaps blindly, chooses the unseen for that which is, but it is certain that it finds its expression in this spirit of the hive which being interpreted means—Co-operation.

Because the bee works on a different community basis from that of man it is perhaps unwise to too hastily deduce from our observation of the hive, conclusions that apply to ourselves, but this spirit of co-operation is continually proving its importance.

All of our lives meet at common centers of interest and it is from these that we can commence, whether this be in connection with our neighborhood, industrial or business life.

There exists in the electrical industry a sincere expression of this spirit. This idea of reciprocity, working together, co-operation.

Successful co-operation cannot be based upon the self interest of either party—for it takes two to co-operate. To let the other fellow do all the co-operating is to inbreed a parasite. There must obtain mutuality and a common cause. Properly expressed others are stimulated to similar action, and when all work for the same end, co-operation, then a code of conduct, becomes irresistible and accomplishment easy.

In the electrical industry all are aided each by the efforts of others. Such interdependence is a plea for the fullest co-operation that the interests of all be best served; the hurt of one is an injury to the rest and to the future years. Let us express the spirit of the hive.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

H. W. Jacobs, electrical contractor, Santa Rosa, is at San Francisco.

Neil C. Hurley, Hurley Machine Company, Chicago, Ill., is at San Francisco.

J. B. Lukes, representing Stone & Webster Company, is at Portland, Oregon.

F. V. McAvoy, Reno Electric Works, is a holiday season visitor at San Francisco.

C. V. Schneider, Electric Supply Company, Sacramento, was at San Francisco last week.

Chas. Fraser, of Fraser Bros., electrical contractors, San Jose, was a recent visitor at San Francisco.

A. B. Saurman, Pacific Coast manager for the Standard Underground Cable Company, is making a month's trip East.

G. Anderson, salesman Electric Appliance Company, is at San Francisco for the holidays, having come in from Arizona.

P. T. Hanscom has resigned as general superintendent of the Great Western Power Company, San Francisco, and left the early part of the week for the East.

N. C. Wolfe, assistant purchasing agent, Mt. Whitney Power & Electric Company, was at San Francisco recently on company business.

H. C. Goldrick, Pacific Coast manager for the Kellogg Switchboard & Supply Company, left San Francisco this week for an Eastern trip.

O. W. Lillard, manager Gould Storage Battery Company, San Francisco, expects to leave shortly for a business trip East. He will visit the company's main office in New York while away.

J. A. Doose, formerly with the municipal lighting plant at Tacoma, Wash., has been made superintendent of the new Tule River power plant of the San Joaquin Light & Power Corporation.

J. Dalziel and **J. Sayres**, electrical engineers with the Midland Railway, England, are making an inspection of the various Pacific Coast electric railway systems, now being at Los Angeles.

Hal Lauritzen, manager western division, Holophane Works of General Electric Company is at Chicago and will visit the company's head office at Cleveland, Ohio, before returning to San Francisco.

S. Glen Vinson, secretary and general manager of the Ideal Electric & Manufacturing Company of Mansfield, Ohio, has been at San Francisco perfecting arrangements for his company's Pacific Coast office.

Paul B. Wilson, formerly district agent of the San Joaquin Light & Power Corporation at Paso Robles has succeeded **Geo. W. Bernhard**, resigned, as agent at Madera. **O. A. Kommers** has succeeded Mr. Wilson at Paso Robles.

L. Wood Davis, formerly traveling salesman with the Intermountain Electric Company of Salt Lake City, and at present with the Westinghouse Lamp Company at their Butte office, is visiting in Salt Lake City during the holidays.

Robert H. Parker, local manager Butte office, General Electric Company, is visiting in Salt Lake City during the holidays. Mr. Parker was formerly local manager of the Salt Lake office, and married a daughter of Salt Lake City's veteran editor, Judge C. C. Goodwin.

H. B. Miller, chairman Oregon Hydroelectric Commission, has named for his executive committee the following: **Judge Thomas C. Burke**, chairman; **John McCourt**, **W. D. B. Dodson**, and **H. L. Vorse**. The committee will meet immediately to direct the investigations of the commission.

Samuel S. Arentz, chief engineer Salt Lake & Utah Railroad Company, who has been in charge of construction since the beginning of work in September, 1912, has resigned and will remain in Salt Lake and engage in private business. Mr. Arentz has been with the firm of A. J. Orem & Company for eight and one-half years, serving as engineer and superintendent in the Silver City, Bingham and Yerington districts, and as chief engineer, Nevada Copper Belt Railway, where he had charge of construction of forty-two miles of line.

OBITUARY.

H. L. Metcalf, late assistant general manager of the Pacific Electric Railway Company, died at his home in South Pasadena on Thursday, the 24th of December, 1913. His funeral on Saturday, the 27th of December, was largely attended. As a mark of respect the Pacific Electric offices were closed during the progress of the funeral.

MEETING NOTICES.

Utah Eectric Club.

The regular luncheon of the Utah Electric Club was held on Friday of this week on account of Christmas falling on the regular meeting day, Thursday. The program committee had provided no regular speaker for this luncheon, but instead had arranged for a day of jollification. A team from one of the local vaudeville houses provided a varied program, which was interspersed by songs and stunts by the members of the club.

Electric Development League of Alameda County.

The regular monthly lunch of the Electric Development League of Alameda county was held in Oakland on December 27th, Co-operation in bettering present conditions and relations between consumer, contractor and dealer, was the subject of a general discussion opened by A. E. Rowe and F. Pinger. A. H. Halloran spoke on Jovianism and also on the advantages of the "electric page." Geo. B. Furniss, president of the league, presided at the meeting.

Joint Meeting Portland Sections A. I. E. E. and N. E. L. A.

Local sections of the above national bodies will hold a joint meeting at 8 p. m. on January 6, 1914, in the Hawthorne building, Portland, Oregon. A paper on "Duplex and Quadruplex Telegraphy" will be presented by B. S. Durkee, chief operator Postal Telegraph Cable Company, Portland, Oregon.

One of the N. E. L. A. Lecture Bureau papers on "Hydroelectric Developments on the Pacific Coast" will also be presented and will be illustrated with lantern slides. Mr. G. P. Nock will preside at the meeting.

TRADE NOTES.

The Washington Water Power Company, Spokane, awarded contracts to the General Electric Company for four transformers for its Long Lake plant. These will be 6500 k.v.a. each.

The calling of the five-day strike of 15,000 employes of the General Electric Company, which was called off on December 1st is stated by the strike committee to have been largely due to a mistake. The committee makes the further statement that there was no intentional discrimination in laying off two employes, that the company is not antagonistic to organized labor and that they do not question the right of the company to reduce the force when necessary in such manner as may be deemed best by the management. The company agreed to place as large a number of employes as conditions will permit.

The Westinghouse Electric & Manufacturing Company reports the receipt of the following orders: Salt Lake & Utah Railway Company, Salt Lake City, Utah: Six 250 kw:. 750 volt, d.c. 3-phase, 60 cycle, 1200 r.p.m. a.c. self-starting rotaries mounted on a common bedplate for operation in series

at 1500 volts d.c.; six 150 k.v.a. 44,000 to rotary voltage, single-phase, 60 cycle, O. I. S. C. transformers with triple secondaries to operate any two or three rotaries at one time, and two switchboards for the above, consisting of seven panels each, also for the Seattle Lighting Company, Seattle, Wash. Two 110 kw., 250-125 volt, 3-wire, 260 r.p.m. compound wound engine type, Type Q generator, complete with field rheostat and balance coils.

The James Kennedy Construction Company, T. D. Hanley manager, Portland, Ore., awarded the contract for a power drilling equipment at St. Helens to Otto B. Goldman, machinery contractor, 303-4 Lewis building. The equipment installed consisted of one 22 h.p. Stover oil engine and an 8x8 Ingersoll-Rand compressor operating at 182 r.p.m. and 110 lb. pressure. The drills used were Ingersoll-Rand 32 lb. and 30 lb. Harzog. Mr. Goldman also reports the sale of two pumps to the Northwestern Electric Company of Portland, Ore., one single stage pump for a capacity of 80 gal. per min., against a head of 110 ft. and the other 3-stage for a capacity of 200 gal. per min. against a head of 200 ft. Jackson centrifugal pumps direct connected to General Electric motors are being used. They will go in the new Pittock Block. Contracts for the new pumping machinery for the city of Linnton, Ore., Mr. Louis C. Kelsey of Portland, engineer, were also awarded to Mr. Goldman. This will consist of two pumps each of 75 gal. per min., one of which will pump against a head of 520 ft., and the other against a head of 585 ft., the highest in Oregon. In order to make them entirely automatic, Cutler-Hammer controllers are being used at the pump house, together with float switches and accessories at the reservoirs, connected to the controls by control wires. An excellent bypass arrangement is being provided for each pump to furnish high pressure when needed for fire protection. Westinghouse motors will be used.

OREGON HYDROELECTRIC COMMISSION.

General investigation of the subject of water power and the development of electric energy was mapped out by the new Oregon Hydroelectric Commission, at its first meeting held at the Portland Chamber of Commerce. The commission was created as a voluntary body last June when the commonwealth congress met at the University of Oregon at Eugene to consider the general welfare of the state. In the main, the commission's plan is to encourage the upbuilding of industry depending upon electric power. To that end, a thorough study of engineering, cost of energy, technical questions of metallurgy and all the problems incidental to the subject will be probed and the results made public in expert reports.

H. B. Miller, former consul-general to China, is chairman of the commission and presided at the conference. Judge Thomas C. Burke, collector of customs, was appointed vice chairman and W. D. B. Dodson, acting secretary. Committees will be appointed on a dozen different subjects, and this task will be undertaken within the next few days so the active work of the commission may go forward with rapidity.

One committee will investigate the present power laws of Oregon to find out whether or not they are discouraging to industries. Another will study power development in its relation to navigation and co-operate with the organization of local legal districts to assess members for development expense and work with the federal government to divide the cost of power development and navigation.

Still another will investigate metallurgical possibilities of the Oregon power sites in the reduction of ores. In this connection, the question of importing iron ores from China for reduction here will be looked into.

The possibility of making nitrates for fertilizer by the agency of this electric energy likewise will be studied and a committee will look into the financial question as it bears on power development—what capital demands and why it objects, if it does object, to such avenues of investment. Other committees will investigate legal matters connected with interstate use of power sites, the use of electricity on the farm, the making of charcoal from stumpage on logged-off land, the effect of water power industries on the labor situation and the economic relation of power development upon civilization generally.

Some engineers have estimated that Oregon now has 3,200,000 potential horsepower in its waters, though others have said 6,000,000 is nearer the amount. The state engineer will co-operate with the commission in learning as nearly as possible, what potential horsepower is available.

EXAMINATION FOR INSPECTOR OF MECHANICAL AND ELECTRICAL ENGINEERING.

The United States Civil Service Commission announces an open competitive examination for inspector of mechanical and electrical engineering, for men only, on January 21, 22, and 23, 1914. From the register of eligibles resulting from this examination certification will be made to fill a vacancy in this position, at $2000 a year, in the office of the supervising architect of the treasury, and vacancies as they may occur in positions requiring similar qualifications.

The duties of the position consist of inspecting and testing the mechanical and electrical equipments entering into the modern government or office building. It is desired that applicants shall have had practical experience in the design, construction, and inspection of work in the following branches of mechanical, electrical, and sanitary engineering. Heating and ventilating apparatus, plumbing, water supply and drainage, conduit and wiring work, elevators, vacuum cleaning systems, and electric generating plants. The duties of the position in which the vacancy exists at present will necessitate constant travel on department business.

Under an act of congress applicants for this examination must be examined in the state or territory in which they reside and must have been actually domiciled in such state or territory for at least one year previous to the date of the examination.

NEW CATALOGUES.

(Under this heading attention is directed to catalogues and bulletins representing the latest information upon the subjects treated. The latest developments are always in advance of the most up-to-date text books. Readers are urged to write direct to the publishers for these catalogues and bulletins, which, unless otherwise stated, are available for free distribution.)

The Automatic Electric Washer Company, Newton, Iowa, is mailing an illustrated descriptive booklet on their make of electrically operated washing, clothes wringing, and ironing machines.

Macbeth, Evans Glass Company, Pittsburg, is distributing a portfolio of plates illustrating their new line of portable lamps. It is uniform in size with their regular catalogue and is entitled Electric Lamps of Distinction.

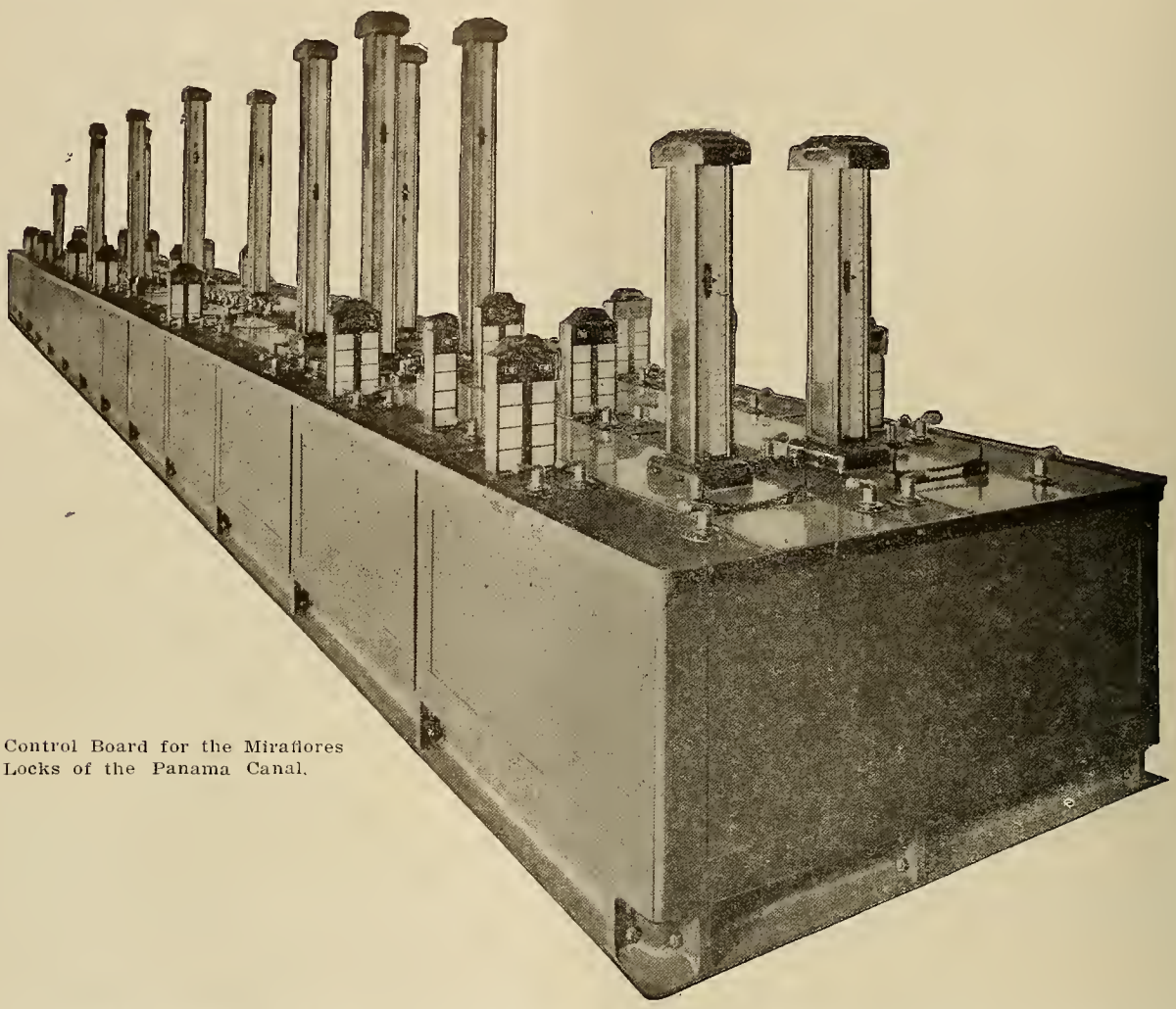
Bulletin No. 531-H issued by the Geological Survey is a report of an investigation of the Horseshoe Bend and Jerusalem Valley coal beds on Payette River, Idaho. It may be secured by addressing Director of the Geological Survey, Washington, D. C.

The Electric Storage Battery Campany has issued a beautiful "Silver Anniversary Book," which gives a synopsis of the company's history since its organization and a description of the various manufacturing departments of the works. Printed in silver and black and bound in covers of gray this brochure is particularly attractive, while the text on the building up of an industry is of exceptional interest.

INDUSTRIAL

CENTRALIZED CONTROL SYSTEM FOR PANAMA CANAL LOCKS.

The electrical specification, design and manufacture of the Panama Canal centralized control system may properly be regarded as one of those undertakings which, from an engineering standpoint, not only arouses a lively interest but also presents an opportunity for much valuable instruction. The complete operation of the canal locks, terminals and auxiliary equipment utilizes electrical energy throughout, with the present exception of the Panama railroad, the electrification of which is under contemplation.



Control Board for the Miraflores Locks of the Panama Canal.

The specifications for the entire generating, lock controlling and distribution system for operating the Panama Canal were prepared under the supervision of Edward Schildhauer, electrical and mechanical engineer, Isthmian Canal Commission, assisted by a staff of able electrical engineers, including C. B. Larzelere, who was closely identified with the lock control problems, and W. R. McCann with the generation and distribution of power. These specifications exhibited great care and painstaking engineering. They contained every safeguard that expert engineers could suggest, were exact and explicit in regard to the results required, yet gave proper range in the details of accomplishment.

All of the lock machinery motors, control panels, centralized control boards, power station generating apparatus, switchboards, transmission line substation equipments, coaling stations, and practically the entire electrical equipment for the wharf terminal cranes and for the extensive permanent repair machine shops were manufactured by the General Electric Company.

The power system for the operation of the locks, towing locomotives, lights for the locks and buildings, and motors not directly connected with the lock control, is composed of:

A 7500 k.v.a., 2200 volt hydroelectric power plant at the Gatun Dam;

A 4500 k.v.a., 2200 volt Curtis turbo-generator electric power plant at Miraflores for emergency, lately used to supply power for construction work;

A double 44,000 volt transmission line across the Isthmus, connecting Cristobal and Balboa with the two power plants;

Four 44,000, 2200 volt substations, stepping down at Cristobal and Balboa, and up or down at Gatun and Miraflores, depending on which of the two plants is supplying power;

Thirty-six 2200-240 volt transmission stations for power, traction and light at Gatun, Pedro Miguel and Miraflores locks;

Three 2200-220-110 volt transformer stations for the control boards at the locks;

Stations at Cristobal and Balboa for coal handling plants, machine shops and dry docks.

The instrument and control board for the Gatun generating station is of natural black slate, as are all the

switchboards for the power system. It is totally enclosed by means of grille work with doors at each end. The switchboards for the transmission line substations are of the vertical type, with control apparatus and mimic connections symmetrically arranged on the middle section of the panels. The rear of the board is enclosed by means of grille work with doors at each end.

Current for the lock machinery and towing locomotives is transformed from the 2200 volt system in the immediate vicinity of where it is used. There are a total of thirty-six transformer stations, for all locks, each containing duplicate 200 k.v.a., 3-phase 2200-240 volt transformers for power and one single-phase 25 k.v.a., 2200-220-110 volt transformer for lighting. The stations, normally fed from the 2200 volt buses in the 44,000-2200 volt substations, can also be operated from the power plants; the stations at Gatun locks from the Gatun hydroelectric station; and the stations at Miraflores and Pedro Miguel from the Miraflores emergency steam plant.



Control House at Gatun.

To give an idea of the number and sizes of motors to be controlled in operating the lock machinery, the following table is interesting:

Machines and Operation.	Motors each Machine. and h.p.	Number of Motors Ga- tun.	Ped. M.	Mira.	Tot	Total h.p.
Miter gate, moving, each leaf.	1-25	40	24	28	92	2300
Miter gate, miter forcing....	1- 7	20	12	14	46	322
Fender chain, main pump.....	1-70	16	16	16	48	3360
Fender chain, operating valve	1- ½	16	16	16	48	24
Rising stem gate valve.....	1-40	56	24	36	116	4640
Cylindrical valve.....	1- 7	60	20	40	120	840
Guard valve	1-25	6	6	6	18	450
Auxiliary culvert valve.....	1- 7	4	4	4	12	84
Totals		218	122	160	500	12020

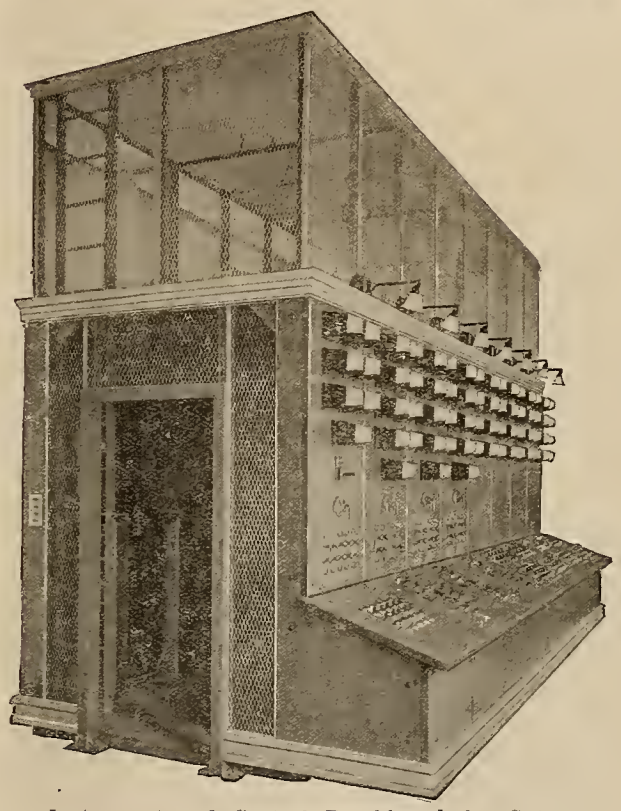
There are many motors not included above, as, for instance, these for the spillway gates, for the hand rails on the mitering gates and for the sump pumps.

The motors are started and controlled by contactor panels located near them, the contactors of which handle the main motor currents. These contactors are controlled from the central control house. The smaller motors, including those for cylindrical valves, auxiliary culvert valves and miter forcing, are started by being thrown directly on the line. Two double-pole contactors are used, one for forward and one for reverse. In the case of larger motors for miter gate moving, rising stem valves and guard valves, a starting point with resistance in two legs of the three-phase circuit is provided.

Location and Operation of Lock Machinery.

From an operating standpoint the machinery was placed below the coping of the lock walls, thus affording a clear space for maneuvering ships and protecting the apparatus from the weather without erecting numerous houses.

The mitering gates consist of two massive leaves pivoted on the lock walls which operate independently of each other. A pair of gates is located where each change of level occurs and divides the locks into 1000-foot chambers. In addition to these gates, at lake and ocean ends are duplicate pairs of gates used as guard gates. To handle the vessels of various sizes with the minimum use of water, mitering gates of the same description as those above are installed, dividing 1000-foot locks into two compartments. These gates are termed intermediate mitering gates. When the mitering gates



Instrument and Control Benchboard for Gatun Hydroelectric Station.

are closed they are what might be termed clamped in this position by a device called a miter forcing machine.

Chain fenders are stretched across the canal in front of all mitering gates which can be exposed to the upper lock level and also in front of the guard gates at the lower end. These chains are maintained in a taut position when the gates behind are closed, and are lowered when the gates are opened for the passage of a ship. The chains are raised and lowered by a method similar to that followed in hydraulic elevators, with the additional feature that if a ship approaches the gates at a dangerous speed and rams into the chain, the chain is paid out in such a way as to gradually stop the ship before it reaches the gates. Lowering the chain for the passage of a vessel and raising it again after the vessel has passed is accomplished by two motors; one driving the main pump supplying water under pressure, and the other operating a valve which controls the direction of movement of the chain. These two operations are combined in one, each motor being stopped automatically by a limit switch when the motor has performed its function.

The filling and emptying of the locks is accomplished by three culverts, one in the middle wall and one in each

side wall, the flow of water being controlled by rising stem valves. They are located in the culverts at points opposite each end of each lock so that the culvert can be shut off at any desired point for filling a lock with water from above, or upstream, or for emptying it by allowing it to flow out and down to the next lock. Lateral culverts conduct the water from the main culverts, under the lock chambers, and up though openings in the lock floors.

Centralized Control and Indicating System.

As the flight of locks at Gatun, for instance, extends over approximately 6200 ft., and the principal operating machines are distributed over a distance of about 4000 ft., it can be readily seen that central mechanical transmission of control of machines would be almost impossible; and to control the machines locally would mean a large operating force distributed practically along the full length of the locks, which has invariably been the practice heretofore. Such a force would be difficult to co-ordinate into an efficient operating system. The situation therefore resolved itself into centralized electrical control, which reduces the number of operators, operating expense, and liability to accident. To accomplish this system of control, a control board for each lock was constructed which permitted having all control switches located thereon mechanically interlocked so as to minimize, if not entirely prevent, the errors of human manipulations.

The control boards are installed in control houses located on the middle walls at points which afford the best view of the locks, although this view is not depended on to know the position of the gates or other apparatus, as all are provided with indicators on the control board. The control boards are made approximately operating miniatures of the locks themselves, and are arranged with indicating devices which will always show the position of valves, lock gates, chains and water levels in the various lock chambers; and with the exception of such machinery as needs only an "open" or "closed" indication, the indications will be synchronous with the movement of the lock machinery.

The indicators were developed especially for this undertaking, and show accurately and synchronously every movement of the machinery to which they are connected, whether in the extremes of travel or at any intermediate point.

Water Level Indicators.

The specifications covering the water level indication required an accuracy of 1/20 of a foot or 1/10 of 1 per cent in actual water level. In the transmitters and receivers for the machines described previously, the rotors turn less than 180 degrees with an inherent lag of 1½ per cent between transmitter and receiver rotors in this distance, which obviously prevents this arrangement from being employed to give the water level indication.

It was found that if the rotors were revolved ten complete revolutions, the required accuracy could be obtained; but since this arrangement makes it possible for the rotors to be in synchronism every 180 degrees, or in twenty different positions for the entire travel, the indicators would not indicate correctly if for some reason the transmitter rotors were turned more than ½ revolution with the power off. Therefore, the required accuracy was obtained by two sets of transmitters and receivers, one set connected to a fine index in which the rotors make ten complete revolutions and the other set connected to a coarse index operating less than 180 degrees.

The fine index is a hollow cylinder carrying a pointer, the length of the cylinder being such that when an aluminum ball representing the coarse index, which can be depended upon for coarse indication, is within the limits of the cylinder, the reading of the fine index is correct within the limits specified. The scales are illuminated by lamps in both base and top caps of the indicator.

For water level indication, wells 36 in. square in the lock walls with communication to the lock by a small opening at the bottom of the well to dampen surges contain a welded steel box float, 30 in. square by 9 in. deep. A non-slipping phosphor bronze belt transmits the movement of the float to a sheave fitted with pins on the transmitter mechanism, the pins registering with holes punched in the belt. The sheave shaft is carried in ball bearings with oil cups for lubrication and drainage cocks at the bottom of the bearings.

The position of the miter forcing machine is not indicated by synchronous indicators, but its open and closed positions are shown by red and green lights and a mechanical indicator on the control board representing the machine.

The control boards are of the flat top benchboard type, 32 in. high by 54 in. wide, built in sections, with total lengths as follows:

Gatun	64 ft.
Pedro Miguel	36 ft.
Miraflores	52 ft.

The side and center walls of the locks are represented by cast iron plates and the water in the locks by blue Vermont marble slabs. The outer edge of the board is surrounded by a brass trim rail, and the sides are enclosed with steel plates which can be readily removed for inspection of the board. The control board is supported by a wrought iron framework resting on base castings, which are in turn supported on the operating floor of the control house.

The control switch handles are mounted above the surface of the board and operate through an angle of 90 degrees. They are provided with name-plates for the "open," "closed" and "off" positions. The space immediately below the flat top of the control board is occupied by the contact fingers of the control switches, mounted on the operating shaft, synchronous receivers and their cable connections. Connection boards are provided for the cables, which are led up from each side, as are buses for supplying current to the control switches, receivers and the lamps that illuminate the scales of indicators. The receivers, transmitters and lamps are operated at 110 volts, while the control circuits are 220 volts, both using 25 cycle alternating current.

In order to make it necessary for the operator to maneuver the control switch handles always in a certain order, corresponding to a predetermined sequence of operation of the lock machinery, and to prevent the operator in control of one channel from interfering with the machinery under the jurisdiction of the operator controlling the other channel, these control switches are provided with interlocks. The interlock system is essentially a bell crank mechanism, connecting the shaft of the control switch through a movable horizontal bar to a vertical operating shaft which can or can not move according to the relative positions of the interlocking bars and dogs.

Nearly two thousand special drawings were required in the fabrication, and there were also involved the following unusual quantities of materials.

Special slate bases	1,300
Small castings	160,000
Screw machine parts	1,200,000
Copper rod and bar—feet	58,000
Asbestos lumber—square feet	9,000
New patterns	650
New jigs, templates, tools, etc	625
Porcelain parts	18,000
Special bus supports	6,800
Gal. pipe (framework)—feet	21,000
Special gears	2,300
Special instruments	640
Miscellaneous sherardized pieces	300,000
Cases for boxing	4,150

The combined weight of the centralized control boards for Gatun, Pedro Miguel and Miraflores is about 39 tons. In their construction there is employed: More than 2¼ miles of interlocking rod; about six million feet of control leads—made up in 5 and 8 conductor cables; 732 indicator motors; 464 control switches.

NEWS NOTES

INCORPORATIONS.

SAN FRANCISCO, CAL.—Reliable Electric Company, capital stock $5000, has been incorporated by A. E. Cerf, J. B. Shlare and Bernard Zellensky.

LOS ANGELES, CAL.—Olston Electric Stove Company; $200,000; subscribed, $50. W. L. Rosa, C. E. Stoner, M. R. Lewis, et al., are the incorporators.

LOS ANGELES, CAL.—Magnetic Trolley Retriever Company, capital stock $500,000; subscribed, $5. J. W. Kays, F. L. Gilman, Louis J. Hembree, Fred L. Dorman, Verna T. Dorman, directors.

TUCSON, ARIZ.—The stockholders of the Cababi Mining Company, which operates the Cahabi mines in southwestern Pima county, have organized a company under the name of the Arizona Power & Water Company, S. G. McWade being manager of both the Cahabi and the new company. The purpose of the organization is to utilize the waters that flows down Cababi canyon in Rincon mountains. The capitalization of the new company is $5,000,000. The plans are to build a dam costing $3,000,000. Power will be generated for the operation of mines, mills and factories and water will be furnished for municipal and irrigation purposes.

ILLUMINATION.

MOLALLA, ORE.—A franchise for lighting this town was asked for by Mr. Burst of Aurora in the name of the Molalla Power Company.

PUYALLUP, WASH.—The council has accepted an electric lighting contract with the Puget Sound Traction, Light & Power Company.

LONG BEACH, CAL.—The board of public works has rejected all bids for installation of a lighting standard system in Pacific Park and has ordered the original plans modified.

SOUTH BEND, WASH.—A gas franchise has been granted to the Henry Pratt Company of Tacoma to build a plant, lay pipes and sell the product here. The plant will be in operation within two years.

BELLINGHAM, WASH.—Improvements costing approximately $8000 are to be made in the gas plant of the Puget Sound Traction, Light & Power Company according to the announcement made by Manager Leslie R. Coffin. The work includes the construction of a concrete foundation to support a steel holder tank.

SPOKANE, WASH.—Three machinery firms are now figuring on the cost of installation of an isolated plant for the generation of electrical energy for light and power at the municipal building and will submit their estimates to Commissioner Fassett, who was instructed to secure estimates for installing a separate plant.

BERKELEY, CAL.—Mayor C. D. Heywood presented an ordinance at the last meeting of the Berkeley council which provides that all light and power wires, with the exception of street car and local trolley wires, be installed in conduits under all permanently improved streets. This ordinance which has been referred to the city attorney, is another step in the city beautiful program under consideration by the Berkeley council.

SALT LAKE CITY, UTAH.—George D. Keyser, commissioner of parks and public property, gave the "kiddies" of Salt Lake City a treat on Wedensday evening by providing the first municipal Christmas tree. One of the large evergreens on the west side of the city and county building grounds was beautifully decorated with colored electric lamps and tinsel and the three surmounted with a large star outlined in incandescent lamps.

LOS ANGELES, CAL.—The railroad commission has rendered a decision reducing the wholesale rate on natural gas piped from the Kern county fields into Los Angeles county from 18c per 1000 ft. to 10c per 1000 ft. The commission fixes this as the rate at which the natural gas may be sold by the Midway Gas Company at the terminus of its line in Los Angeles county to the distributing companies which retail the product in Los Angeles city and surrounding municipalities. Based upon the amount of gas used, the reduction will amount to from $250,000 to $300,000 per year.

SALT LAKE CITY, UTAH.—Mayor Samuel C. Park of Salt Lake City announces that the new contract with the Utah Light & Railway Company for the supply of street lighting for a period of three years commencing January 1, 1914, has been approved by the city commission. The city has at the present time approximately 1100 street lights, 80 of which are connected by means of underground mains and the balance by overhead circuits. Under the contract just expiring the city paid a rate of $5 per lamp per month for 4-amp. luminous arc lamps. The new contract provides for the same system of illumination, but the rate is reduced to $4.75 for lamps in the underground district and $4.50 per lamp per month for lamps connected by overhead circuits. The new rates will effect a saving to the city of approximately $6600 per year, and Mayor Park states that this amount will be expended for additional lights, which are now badly needed.

TRANSMISSION.

LOS ANGELES, CAL.—Plans are being made by the Tulare County Power Corporation for the expenditure of $80,000 for extension of the service in the district bounded by Exeter on the north, Sausalito on the south, Windsor on the east and Tulare on the west.

PORTLAND, ORE.—Three big crews of linemen and a squad of metermen started out a few days ago to connect the light and power service of the Northwestern Electric Company for its customers here. The new company has a distribution system for light and power through the East Side, both in the business and residence sections.

SAN BERNARDINO, CAL.—The sum of $1,500,000 is to be expended within the next year by the Southern California Edison Company in the construction of two big power houses on Bear and Santa Ana creeks, in the San Bernardino mountains. Preliminary work will be commenced at once, and actual construction will be started in the spring.

HOLLISTER, CAL.—Seven transformers of 400 kw. capacity each, will be installed in the new substation of the Coast Counties Gas & Electric Company, now completed, three, as soon as they can be moved into the building and the other four before the coming summer increase in the consumption of energy. The substation building is of reinforced concrete construction with a smooth plaster inside finish and covers a floor space of 21x30 ft. The present equipment of the company will handle a load of 1200 kw.

BAKERSFIELD, CAL.—Initiative petitions will be put in circulation here right away looking to the calling of an election to decide whether control of local public utilities shall be taken from the board of trustees and lodged with the state railroad commission. The matter of public service control is divided into ten separate propositions, each referring to the control of a certain public utility as follows: Street railroads, railroads, other common carriers, water corpora-

tions, gas corporations, electrical corporations, telephone companies, telegraph companies, warehouse men and wharfingers.

SAN FRANCISCO, CAL.—Commissioner Eshleman presided at the hearing of an application in which Judge Chas. W. Slack, on behalf of the California Power & Manufacturing Company seeks to secure the right to furnish electric energy from a 10,700 h.p. installation on Hat Creek, in Shasta county, to the district in Lassen and Siskiyou counties. The Pit River Power Company that controls water rights, appeared and opposed the granting of a certificate of public necessity and convenience in the territory embraced in a prior order of the commission, allowing the Pit River concern to operate therein.

LOS ANGELES, CAL.—Plans to develop a municipal power project, involving an expenditure of $10,000,000 in Mono county, were outlined before the state board of water power control by attorneys and engineers representing the city of Los Angeles. A tunnel 26 miles long, to carry water from streams tributary to Mono Lake into the Owens River Valley, where it will be merged with the Los Angeles aqueduct project, is one of the most pretentious features of the proposed undertaking. Three power plants in Mono county are also projected. These plans were revealed in explanation of Los Angeles' opposition to the application of E. G. Ryan who had asked for permits to appropriate water from Rush Creek and Leevining Creek, in the vicinity of Mono Lake.

TRANSPORTATION.

WINSLOW, ARIZ.—J. F. Mahoney has applied to the city council for a franchise for a street railway, stating that work will begin at once upon granting of the franchise.

VALLEJO, CAL.—The Northern Electric Railway will erect a warehouse at Front and M streets in Sacramento, at a cost of $23,900. Murcell and Haley have the contract.

VISALIA, CAL.—An ordinance has been adopted by the city trustees granting to the Big Four Electric Railway Company a 50-year franchise to construct and operate a railway along certain streets of this city.

DIXON, CAL.—The town trustees have decided to grant a franchise to the Sacramento Valley Electric Company and to the Northern Electric Railroad Company, permitting them to build and operate an electric railway on First street, providing the state railroad commission will allow the crossing of the Southern Pacific tracks in the northern part of town to be made at grade. The franchise has a 50-year limitation and work must begin within three months after granting of the permit, and the track finished in the town within six months.

SALT LAKE CITY, UTAH.—Regular service over the Utah Light & Railway Company's interurban extension into Davis county has been inaugurated. Official announcement of the opening of the new line was made by General Manager Joseph S. Wells following a trip of inspection made by Mr. Wells, accompanied by George Manning, superintendent of railways; John Williams, assistant superintendent; L. L. Dagron, engineer; O. A. Honnold, electrical engineer, and W. M. Scott, superintendent of electric lines and service. The territory tapped by this thirteen-mile extension into Davis County is one of the richest in the State of Utah. Truck gardening and other forms of intensive farming are followed there, and the improved service afforded should add much to build up this locality.

SALT LAKE CITY, UTAH.—Decision to spend $100,000 in constructing joint carbarns for the use of the Salt Lake and Ogden or Bamberger Line and the Salt Lake and Utah or Orem Line, was reached at a conference between Simon Bamberger, president of the former company, and W. C. Orem, president of the latter company. These barns will be located on Third West between Third and Fourth South, according to the statement issued by Mr. Bamberger after the conference. They will be approximately 90 ft. by 130 ft. and will contain 3000 ft. of trackage with space to accommodate 60 cars. The move of the two roads in deciding upon joint carbarns is in line with the announcements made some time ago that a joint terminal station will be built on the west side of West Temple between Second and Third South streets.

TELEPHONE AND TELEGRAPH.

GLOBE, ARIZ.—According to W. A. Candless of the Mountain States Telephone & Telegraph Company, a new line is to be built from Globe to Ray. The other end of the line has been completed and work will start shortly at the Globe end of the line.

SAN FRANCISCO, CAL.—The Pacific Telephone & Telegraph Company has just approved estimates amounting to $453,850 for the construction of a toll line across California and Nevada, to be made part of a transcontinental line that will make possible continuous telephonic communication between San Francisco and New York. The company's new line will extend from San Francisco to Calvada, on the California-Nevada boundary line and thence to Wendover, Nev., near the Nevada-Utah boundary line, where it will connect with the Mountain States Telephone & Telegraph Company. The Mountain States Company is now building a line from Denver to Wendover. Telephone communication is now possible between Denver and New York, and it only remains for the Pacific and Mountain States companies to build and connect their lines to make telephone communication possible from the Pacific to the Atlantic. It is estimated that the cost of the toll line from San Francisco to Calvada will be a little over $86,000, while the cost from Calvada to Wendover will be something over $367,000.

WATERWORKS.

TACOMA, WASH.—A contract has been awarded to E. R. Moore for $19,000 for the construction of a water pipe line four and one-half miles long. Wood pipe will be used.

GLENDORA, CAL.—Glendora voters have authorized a bond issue in the sum of $25,000 for the purpose of establishing a municipal water system. The municipality has an option on a private plant at present supplying the city to cost $10,000.

BOW ISLAND, ALTA.—The town council has signed up with the Bow Island Sewer, Pipe & Tile Company to supply them with natural gas and water. The company is capitalized at $250,000. Work on the plant is to be started immediately.

LOS ANGELES, CAL.—Bids will be received up to February 2, by board of supervisors of Los Angeles county, for a pipe line franchise granting the right to lay and maintain for a period of 40 years, a system of water pipes in certain portions of the county.

MANHATTAN BEACH, CAL.—An ordinance has been adopted by the board of trustees ordering the issuance of municipal bonds of the city of Manhattan Beach, in the sum of $111,000 for the acquisition, construction and completion of a municipal waterworks system. The bonds are 150 in number, of $200, $500 and $1000 denomination, with interest at 6 per cent per annum, payable semi-annually.

RENO, NEV.—Councilman Frish brought about a precipitation of the water question when he introduced an ordinance at a recent meeting which called for support of the Galena Creek project which has been forwarded by Jas. J. Chambers of Salt Lake. He moved that the council adopt the plan suggested by Chambers to sell to the city a municipal water supply for $750,000, which was to be supplied from the water of Galena Creek. The matter was laid over.

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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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BY THOMAS W. ROLPH.

SERVICE CONNECTION RULING.

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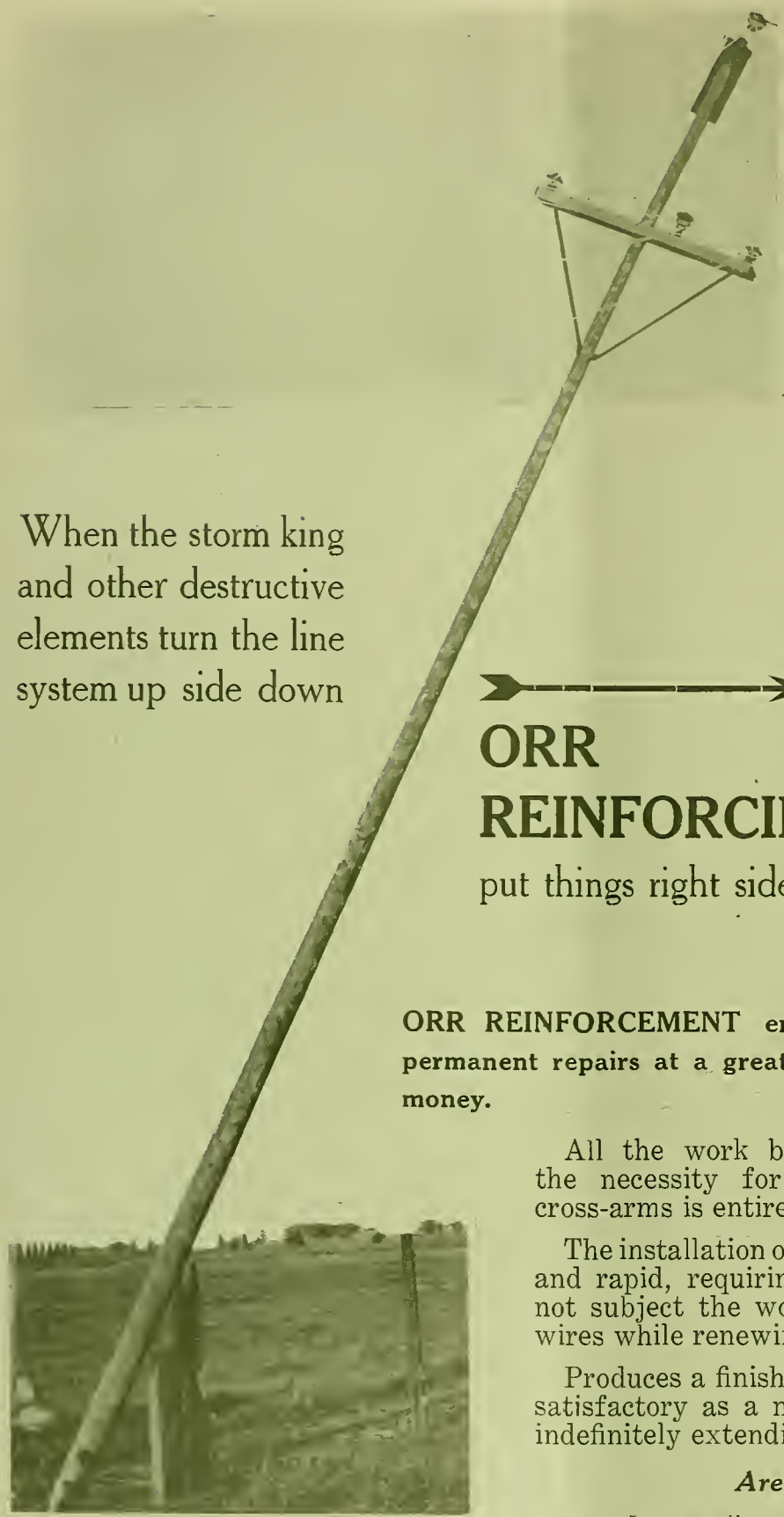
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JOURNAL OF ELECTRICITY

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VOLUME XXXII SAN FRANCISCO, JANUARY 10, 1914 NUMBER 2

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TRANSMISSION LINE CONSTRUCTION DIFFICULTIES

The story of the construction of the Vancouver Power Company's new steel tower transmission line is a further corroboration of the statement that water power sites are never given away; that considerable development is invariably essential, and that difficulties have to be met which would be discouraging to the average individual. But these projects are conceived by those real engineers, who are the prophets of accomplishment; they who uncover nature's most carefully guarded resources, and who then bend them to their will—the efficient service of the people. For them even the overshadowing barrier of the mountain does not baffle, but braces endeavor to its submission; it is tunnelled, traversed or removed.

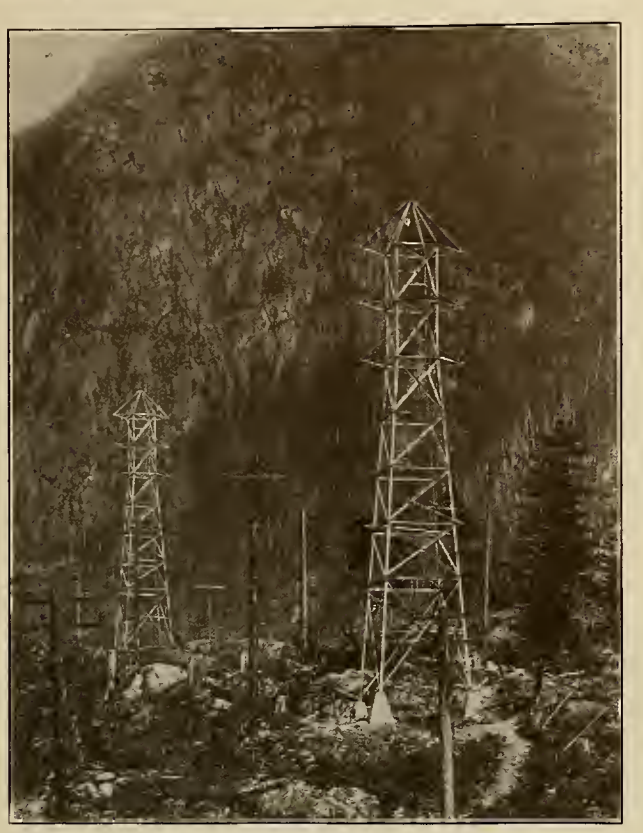


"In places at water level and at others 500 ft. above Lake Buntzen."

The Vancouver Power Company is connected with the British Columbia Electric Railway Company, Ltd., Vancouver, British Columbia, and the Fraser Valley & Southern Railway Company, Ltd. The Vancouver Power Company generates and distributes the energy to the other concerns, which operate on the mainland of British Columbia, over a very extensive territory, including North Vancouver and suburbs on the north shore of Burrard Inlet, Vancouver, South Vancouver and a great number of smaller municipalities, and the connecting rural districts as far south as the United States border line, and east, approximately 100 miles to Chilliwack.

The Vancouver Power Company's system has heretofore been operating at 34,000 volts, transmitted over wooden pole lines, but with the installation of an additional 42,000 h.p. at the new No. 2 power house —which is situated a short distance from the first power house of this company, just below Lake Buntzen, on the north arm of Burrard Inlet—it was de-

cided to increase the line voltage to 60,000 volts, and to adopt steel towers wherever possible, in place of the former wooden poles. This is the second change made necessary within a few years on account of the rapid growth of the company.



"The overshadowing mountains do not baffle."

One section of steel tower line recently completed is seven miles in length and extends from No. 2 power house to Barnet, where the main transmission lines into Vancouver are strung across Burrard Inlet.

It will be noticed that in the construction of this line operations were started at sea level, and practically completed there also. But this is no indication of easy construction, for within the short distance of seven miles it was necessary to work up to and over an elevation of 2000 ft.—a condition not often encountered in line construction.

To further appreciate the difficulties overcome by the contracting engineer, Mr. Tully R. Cornick of Vancouver, B. C., who carried the work through to a successful issue, the characteristics of country traversed should also be considered.

To say that it is rocky or mountainous is not sufficient. The densely wooded, precipitous slopes are covered with fallen timber, and in other places a dense undergrowth makes travel difficult, if not impossible, while in the depressions muskegs are also encountered. Over these it is necessary to throw hastily constructed bridges in order to permit safe passage even to man. Pack horses mired in these, sometimes sink up to their bellies immediately, and are only extricated with great trouble.

It was next to impossible to discover a level space along the entire route sufficient in extent to permit assembling the towers which it was found necessary to construct in a vertical position. Camps had also to be pitched on rafts, which were built on both Deer Lake and Lake Buntzen.

Add to these difficulties the danger of erecting steel towers in close proximity to "hot" high tension lines and the magnitude of the task and the daring



"In the depressions muskegs are also encountered."

of the engineers who conceived it can be better imagined.

But with skill plus, all things are possible and accomplishment is recorded.

The transportation of material for this project occasioned great difficulty. Scows were employed for shipping all construction material from Vancouver to the power house on the north arm of Burrard Inlet. It was then carried up the steep mountain side to Lake Buntzen on an inclined railway built by the company for construction purposes. Then rafts were requisitioned and these, hauled by motor boat, conveyed the material across the lake. Here the greatest difficulties were encountered, for from the lake shore onward, with the exception of the Deer Lake stretch, pack trains and the sturdy limbs of the workmen were the only methods of transportation possible. The steel was carried by the workmen, and the cement, gravel, sand, and even the water for mixing the concrete, was packed in on horseback, South African water bags being used for this purpose. The train consisted of twenty-five horses all told. Several row boats and three gasoline launches were also utilized for lake transportation.

A pole line right of way is not to be confused with the easily traveled roadbed of a railway, and that of the Vancouver Power Company from the Lake Bunt-



"In close proximity to 'hot' high tension lines."

zen power house to Barnet, which is 100 ft. in width, is exceptionally rough. The old system consisted of two pole lines of two circuits each, the poles being located twenty-five feet from the center line of this 100 ft. right of way.

work in stringing the cables, as well as in tower construction.

In this section are sixty-three standard towers and two special. Of these last, one is at No. 2 power house and the other is to be located at the Barnet crossing. The first of these towers only has to date been erected. It weighs no less than five tons.

The tower foundations are of concrete, and these were poured and the anchor bolts placed before the tower material arrived on the ground. Wherever possible the tie rods were cement grouted into the solid rock. Preparation of the majority of the foundations was rendered extremely difficult on account of the proximity of the live lines, the necessity for the continued operation of which would not permit of blasting.

The towers are 62 ft. 6 in. in height from foundation level, and the lowest cable is 40 ft. 6 in. from the ground. A ⅜-in. steel wire, used on each tower for grounding purposes, is carried right up to the apex.

Two three phase circuits using No. 3/0 semi-hard drawn seven strand hemp core copper cables are used; the distance maintained between conductors being seven feet. Standard O. B. suspension insulators and hardware are used throughout.

From power house No. 2 at sea level to Lake Buntzen is a distance of only one-half mile, but the difference in elevation is no less than 500 ft.

A further idea of the ruggedness of the country can be gathered from the fact that the new transmission line, which follows the shore of Lake Buntzen for approximately three miles, is in places but a few



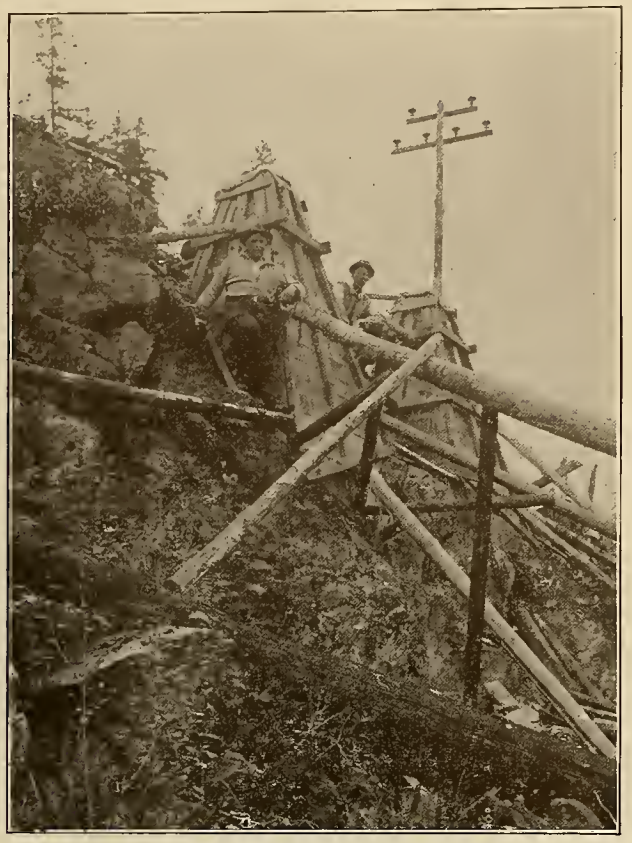
"Even the water for mixing concrete was packed on horseback."

It was the original intention to construct the steel towers right on the center line, but as the angles would be too great for safety, this idea was later abandoned as impracticable. The new line consequently crosses the old lines at several places, and at others is directly overhead, causing considerable close

feet above lake level, while at others it is as high as 500 ft. above it. This is due to the indented nature of the lake shore, along which are to be found at frequent intervals, high bluffs and crags.

From the southerly end of the lake the line rapidly reaches the highest altitude. "The Summit," a

mountain peak 2000 ft. above sea level. Here was poured on a precipitous bluff, the highest tower foundation. The foundation forms were over 12 ft. high on one side, while on the other, no more concrete was used than was necessary for levelling purposes, the two legs of the tower being fastened to solid rock.



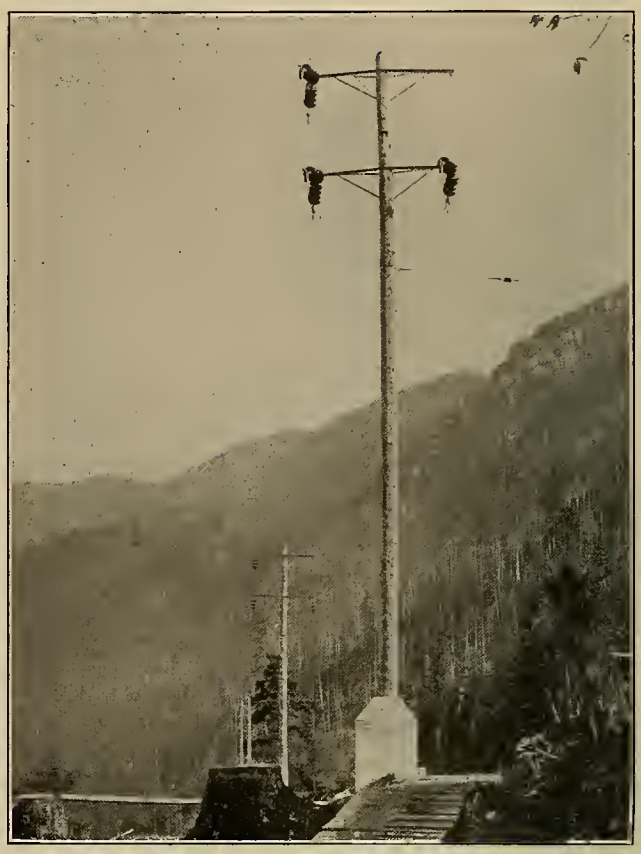
"The highest foundation.

From this point the line drops rapidly in its winding course to Barnet, passing Deer Lake, which is approximately 200 ft. above sea level, en route. This lake is ¾ of a mile in length and was used for the purpose of construction camps and transportation.

The Vancouver Power Company also built a three phase 60,000 volt wooden pole tie-line between power houses Nos. 1 and 2. This line, which is about 2300 ft. in length, also carries a ground wire which is also used as an equalizer. This line will be later replaced with a steel tower line and the present one used for two 2200 volt circuits and the necessary telephone wires.

The manner of re-inforcing the bases of the poles on this line merits explanation. The entire stretch of ground between the two power houses is solid rock with but a thin layer of earth over. In placing these poles a 2¼ in. hole 2 ft. deep was drilled out of the rock and a 2 in. hole bored in the butt of the pole. A 4 ft. length of 2 in. round iron was cement grouted into the rock and the pole set over this. Eight holes were also drilled into the rock around the pole to the same depth. In these re-inforcing iron rods ⅝ in. diameter were placed and allowed to stand 2 ft. 6 in. above the level of the rock. Molds were then built and concrete poured, which formed a solid block 3 ft. 6 in. square and 5 ft. in height.

Mr. T. R. Cornick, who undertook the entire work in connection with the construction of this steel tower line, handled, as field superintendent, the erection of the Mexican Light and Power Company's steel trans-



"The manner of reinforcing the bases."

mission lines (170 miles of direct transmission), under Mr. R. F. Hayward, now general manager Western Canada Power Company, and later erected all the ground wire masts and cable on the same line as an independent contractor. This work was accomplished within a closeness of 30 in. to 60,000 volt line cables. Coming to Vancouver at the inauguration of the development of the Western Canada Power Company's project at Stave Lake, Mr. Cornick built the entire steel tower high tension system for this company by independent contract work between the generating point at Stave Lake and Vancouver, a distance of 32 miles. The contract he has just lately completed forms the first section in the work of rebuilding the Vancouver Power Company's high tension lines between Lake Buntzen and Vancouver.

The next section to be undertaken will be the construction of a similar line from power house No. 1 to Port Moody, a line of about the same length as that here described and through a country in which equal difficulties will have to be overcome.

The national rivers and harbors congress at Washington, D. C., adopted resolutions recommending the creation of a department of public works with a cabinet official at its head; an annual rivers and harbors appropriation from congress of $50,000,000; the standardization of the depth of waterways; the making of laws compelling freer interchange of interstate traffic; prohibition of domination by railways of water traffic, and state or municipal ownership of water terminals.

WASTE DUE TO NON-USE OF WATER POWER

BY W. V. N. POWELSON.

(Concluded.)

Arguments Against a Limited Tenure.

The question of a limited tenure for the use of water power has been the subject of much controversy. Because I believe there is much merit in the arguments of those who affirm that it is against the true interest of the public to limit the tenure of sites granted to public service corporations, except for breach of contract, I will summarize as best I can their position.

A public service corporation created by the state and engaged in a work of internal improvement is quasi public in character and is entitled in many states to exercise the state's sovereign power of eminent domain. The generation and distribution of electricity to municipalities and the public generally is a public use, and an association organized as a public service corporation engaged in generating electricity by water power and offering it for sale to the public is in effect an agent of the state supplying a public use and as such is subject to the state's supervision and control.

Most states have by legislation provided the machinery to give effect to this right to supervise and control, and it should be conceded that those states that have not yet done so will not neglect much longer to give effect to those rights.

The state's sovereign power to supervise and control a public service corporation extends not only to the power to regulate and fix prices, but it extends to the character of the service and to every act which directly or indirectly influences the public welfare.

The business served by a public service corporation supplying electricity never ends its growth. It is, so far as experience teaches, continually growing and expanding.

In prosperous communities the annual requirements of such companies for new capital for improvements and extensions often largely exceeds the annual net earnings and at times exceeds the annual gross earnings, so that the ability of the company to give adequate service is dependent upon its ability to continually secure money for its extensions. If for any reason the credit of a company is impaired, its ability to make extensions is impaired, and to that extent its ability to adequately serve the public is impaired.

A public service corporation operating a water power under a limited tenure would not be able to raise money for extensions or improvements which it could not demonstrate would be returned, principal and interest, out of earnings prior to the limit of its tenure.

During each succeeding year of operation the sinking fund percentage on moneys expended for improvements during the year would have to be increased. This would necessitate an increase in price each year, which the state's right to control might not be able to prevent, because the state's right does not extend to a confiscation of property, and the prices may not be regulated below a point which would prevent the return to investors of the principal, with interest, at the expiration of the tenure period.

Prices would thus grow each year until they reached the limit of what the traffic would bear. Above this they could not go; so that when this limit was reached the demand for new capital for extensions would automatically cease and growth would end.

The community would thus be without adequate service and would be paying for such service as was rendered all the traffic would bear, with the further disadvantage of not being able to get any more service even at such a price.

At what stage in the tenure period this condition would occur would depend upon how cheaply the water power could produce electricity. If the cost was substantially equal to that by coal then this condition would be reached early in the tenure period. If the cost was lower, then this condition would be reached later.

To make clear why, after the water power is put in operation, there is need for such a constant supply of new capital, I may say that it is seldom that the initial expenditure at a water power site fully develops it. The initial expenditure is kept as small as possible consistent with the existing market. As new business is secured, further expenditures are necessary both at the hydroelectric plant and in added transmission facilities.

It is proper to include the cost of the transmission facilities in the amount to be amortized, because this is merely the body, in which the water power is the heart. If deprived of the heart's action, the body dies.

To properly perform its function to the public, a public service corporation should be able, indeed it should be required, to serve within its sphere every legitimate need of the public. If the public welfare requires that the corporation should enter into long-time or even perpetual contracts with its consumers, it should be under no legal disability to do so.

One case will illustrate the point. Many of the western power sites when developed will supply large quantities of power for irrigation to be used in pumping water on lands that can not be profitably irrigated by coal power. It is the experience that irrigation projects can not be financed unless the water right is perpetual and runs with the land. If this be true, then such irrigation projects as I have described can not be financed without a perpetual contract for power. Obviously a public service corporation may not make a contract for service beyond the limit of its tenure unless the state is obligated at such date to take over and assume the contract.

More could be said on this general subject of credits, prices, and service, but I think I have said sufficient to show the baneful influence upon the usefulness to the public of a public service corporation operating a water power under a limited tenure.

However expedient it may be considered to apply the principle of limited tenure to a water power built to serve a private use, I think we should, in view of the arguments just stated, gravely consider whether in the case of a public service corporation acting as the agent of the state the proposed requirement of a limited tenure should not be abandoned.

LIGHTING METHODS

SPACING OF LIGHT-UNITS.

BY THOMAS W. ROLPH.

(In this article is given a method for determining the proper spacing of light-units when their photometric curves are available. It will be found of great value to the practicing illuminating engineer.—The Editors.)

The degree of uniformity of illumination obtained in any lighting installation depends upon the spacing of the light-units. When several units are used to light an area it is desirable to arrange them in the form of squares or rectangles as nearly square as possible. The ratio of the length of one side of the square to the height of the light-unit above the horizontal plane on which illumination is desired, is the important factor in determining uniformity of illumination. This ratio

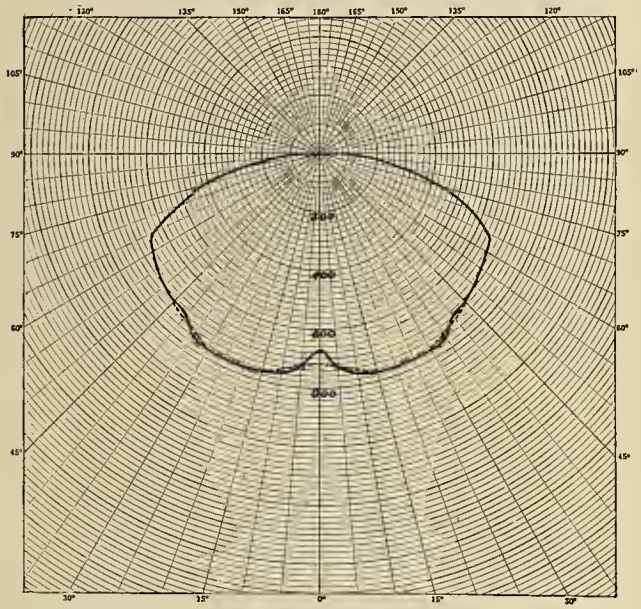


Fig. 1.

is usually referred to as k, and is called the spacing constant. With any given installation of light units if the distance apart and the height are varied in such a manner that k remains constant, the uniformity of illumination will not be affected, although the average intensity of illumination will vary.

For any value of k there is a minimum photometric curve for uniform illumination. This curve will give at that particular spacing the highest illumination efficency consistent with uniformity of illumination. The familiar extensive, intensive and focusing reflectors are designed to approximate such curves. The values of k for the extensive. intensive and focusing curves are respectively 2, 1¼ and ¾. In other words, if it is desired to mount the light-units at k = 2 or the height one-half the distance apart, the most efficient curve giving uniform illumination is the extensive curve. As a general rule, spacing light-units closer together or higher than their correct k-value calls for, still gives uniform illumination, but decreases the illumination efficiency. Spacing light-units farther apart or lower than their k-value calls for, increases the illumination efficiency and decreases the uniformity. It is sometimes desirable to do this, sacrificing uniformity to a certain extent in favor of efficiency.

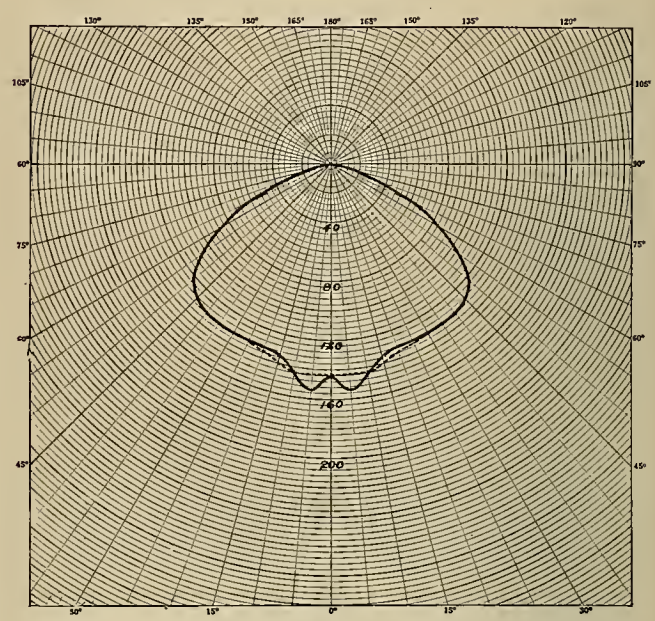


Fig. 2.

When the well-known extensive, intensive and focusing reflectors are used, it is a simple matter to

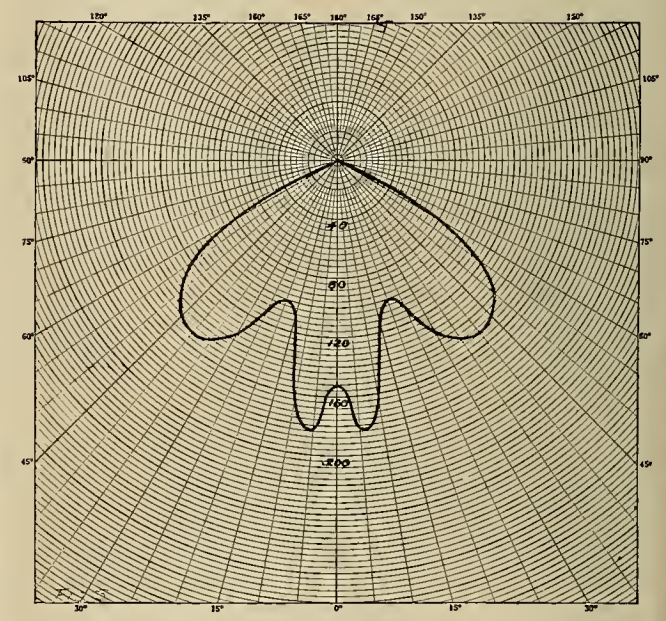


Fig. 3.

space the light-units correctly. It often happens, however, that light-units giving other curves are to be used. For nearly every light-unit there is some minimum value of k at which the best uniformity is obtained. Given the photometric curve, this value can be obtained by the method described below. It should be noted, however, that this method is applicable only

to curves having not more than one general change in curvature in the lower hemisphere, such as the curves shown in Figs. 1 and 2. What might be termed freak curves, such as shown in Fig. 3, cannot be spaced to give uniform illumination efficiently. They are undesirable for general illumination.

To determine the best k-value for curves as shown in Figs. 1 and 2, any slight irregularities should be first eliminated and the dotted line curves shown in the figures should be used. These dotted line curves are for practical purposes the same as the solid line test curves. After making this revision in the curve, it should be compared with the "critical angle curve"

Table I.

Critical Angle.	k.	Critical Angle.	k.
10°	.35	31°	1.20
11°	.39	32°	1.25
12°	.43	33°	1.30
13°	.46	34°	1.35
14°	.50	35°	1.40
15°	.54	36°	1.45
16°	.57	37°	1.51
17°	.61	38°	1.56
18°	.65	39°	1.62
19°	.69	40°	1.68
20°	.73	41°	1.74
21°	.77	42°	1.80
22°	.81	43°	1.87
23°	.85	44°	1.93
24°	.89	45°	2.00
25°	.93	46°	2.07
26°	.98	47°	2.14
27°	1.02	48°	2.22
28°	1.06	49°	2.30
29°	1.11	50°	2.38
30°	1.15		

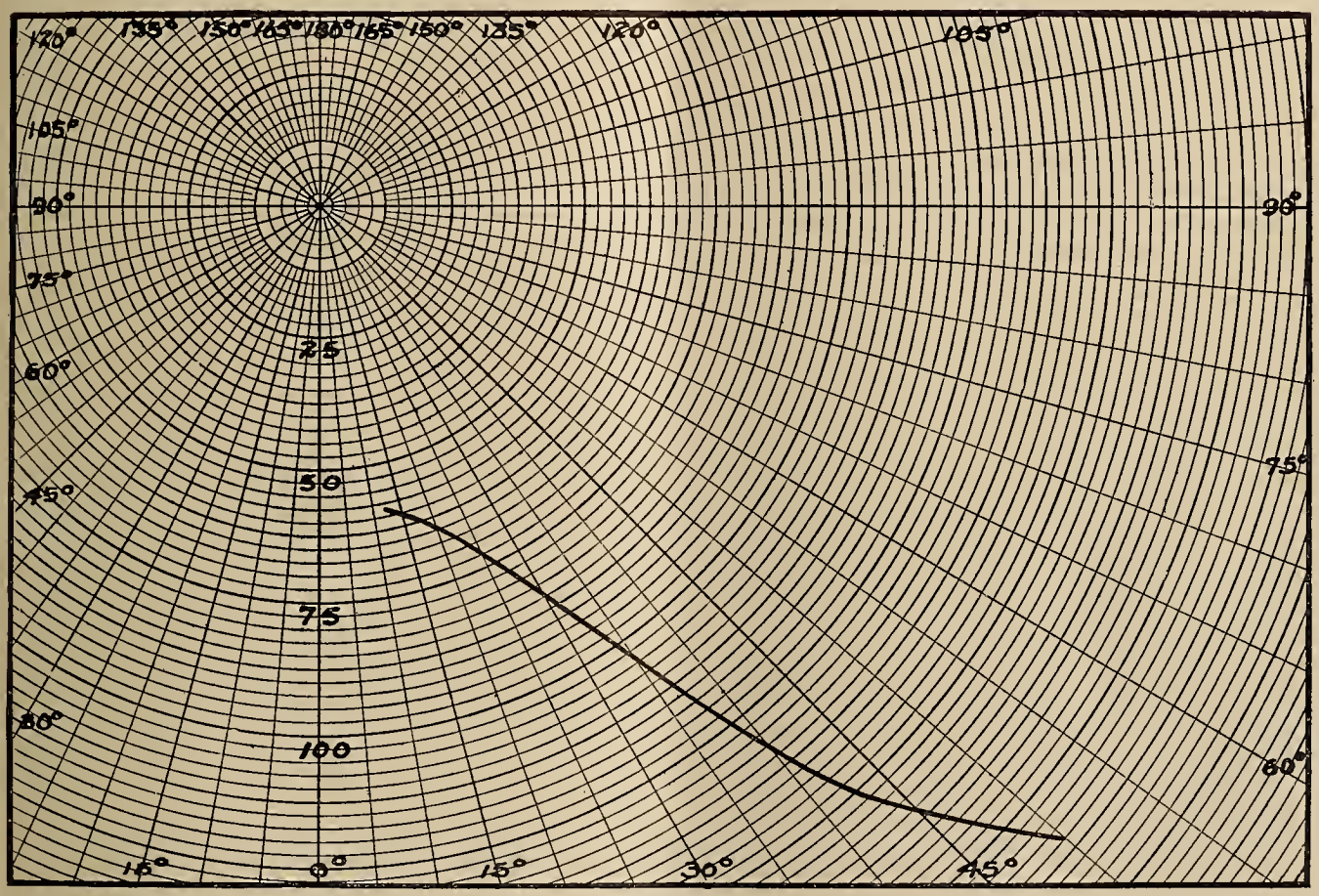


Fig. 4.

shown in Fig. 4. This curve is derived from the prototype or original extensive, intensive and focusing curves.[1] The photometric curve (dotted line) should be plotted to the scale 100 units downward; i. e., all the values should be increased or decreased in the proportion which will make the downward intensity 100. Comparing this curve with the critical angle curve the angle of intersection should be observed. Referring then to Table I the value of k can be obtained.

This method has been found to give results sufficiently accurate for all practical purposes, and with a careful observance of the limitations pointed out above it may be used with confidence by the designer of lighting systems.

[1]See "Standard Relations of Light-Distribution"; Arthur L. Sweet. Transactions Illuminating Engineering Society, November, 1909.

Uniform illumination is a result of correct design of the lighting appliance and its proper installation. In what is known as direct lighting, the area which can be uniformly illuminated with a certain lamp or quantity of light flux, is not dependent upon the height of suspension or the intensity upon mounting height, where reflectors of proper design are used. In this connection, the law of inverse squares—that light varies inversely as the square of the distance from its source—may be misleading and causes many to arrive at wrong conclusions. By use of a properly designed reflector the light flux may be so distributed that the same floor area or reference plane will always be uniformly illuminated, and with the same intensity, irrespective of the mounting height.

SERVICE CONNECTION RULING.

The following is decision No. 1164 of the Railroad Commission of the State of California in the case heard before Commissioner Max Thelen, of Edgar L. Stewart, complainant versus Great Western Power Company, a corporation, defendant:

Opinion.

This complaint was filed for the purpose of compelling the defendant to serve complainant with electric energy for lighting, heating and power purposes. The complaint alleges, in effect, that on or about July 1, 1912, the defendant agreed to supply complainant forthwith, at its own expense, with electric current for lighting, heating and power and that for that purpose it would construct, at its own expense, an electric transmission line to complainant's house, located on his ranch, about half a mile northwesterly from the village of Denverton, in Solano county, California; that the defendant has frequently represented that it would give such service to the complainant but that it has failed to do so; that the complainant, acting on the representations of the defendant to the effect that it would soon supply him with electric energy, incurred an expense of some $200 in wiring his house and preparing for the reception of electric energy; that defendant has refused to supply complainant unless complainant, at his own cost and expense, should build a transmission line to convey the electric energy from the lines of the defendant to complainant's house; and that defendant has built its lines as far as the village of Denverton and is now supplying electric energy at said place. The complainant asks this commission to make its order compelling defendant to construct a line to complainant's home and thereafter to supply complainant with electric energy.

The defendant thereafter filed its offer to satisfy the complaint, offering to reimburse the complainant all his expense, not exceeding the sum of $200, for labor and material incident to the wiring of complainant's house in preparation for the reception of electric energy, provided that the complainant would agree to repay this sum to the defendant when electric energy should be supplied to the complainant by the defendant or by any other central station company. The complainant refused to agree to this offer to satisfy his complaint.

The defendant thereafter filed its answer denying most of the material allegations of the complaint.

The answer states that defendant is willing to supply complainant if he, at his own cost and expense, will build a line to convey electric energy from Denverton to his house and will install the transformer necessary to reduce the voltage of defendant's current from 22,000 volts to 220 volts, or if complainant will secure for the defendant a right-of-way over the land intervening between complainant's house and defendant's 22,000 volt line at Denverton and will reimburse defendant for its cost and expense in furnishing and installing the necessary and proper transformer, poles, wires and other equipment in order to enable the defendant to deliver current to the plaintiff. The answer further sets forth that although the complainant's business was solicited by one of the defendant's agents on or about July 8, 1912, it thereafter became impossible for the defendant to secure the necessary right-of-way over the land contiguous to the premises of the complainant, with the result that defendant was unable to build its transmission main across complainant's premises as it had anticipated doing, but found it necessary to construct said main at a distance of about one mile from complainant's premises. The answer further alleges that it would cost defendant over $1800 to prepare itself to supply complainant with electric energy and that the average monthly revenue which it would receive from the sale of current to complainant, in accordance with his original application, would not exceed the sum of $7.50 per month, or $90 per year.

The hearing in this case was held in San Francisco on December 4, 1913. It appeared at the hearing that on July 8, 1912, the complainant signed an application for electric service from the defendant, which application was headed "Contract for electric current," but contained the clause that it should not become binding on the company until accepted by its sales manager. It was never so accepted. Certain agents of the defendant, however, held out to the complainant from time to time the hope that he would soon be served. The application was for a connected load of approximately .72 kw. for twelve 16 c.p. carbon lamps and for 7½ h.p. at 220 volts, for pumping purposes. It appeared at the hearing that complainant, relying largely on the representations of defendant's agents, had wired his house at an expense of $200 and that he would consume electricity for lighting his house, by means of some 50 electric lights, and also for a 1 h.p. motor in his dairy, and possibly for an electric range. It appears that at the time this business was solicited, defendant expected to construct its 22,000 volt transmission line from Isleton to Napa over and across the property of complainant and his neighbors, but that defendant thereafter was unable to secure a right-of-way over the property of certain neighbors of complainant on terms satisfactory to the company and that it thereafter constructed its transmission line between said points on a public highway about one mile north of complainant's house. It appeared that for a distance of some 20 miles no current is taken from this transmission line, with the exception of current used to supply certain requirements of the Solano Irrigated Farms Company in and about the community formerly known as Denverton. The necessary distributing lines to supply these needs were constructed at the expense of the Solano Irrigated Farms Company and are their property.

It appears that if defendant is to serve complainant there are two possible methods of securing this end: (1) the construction of a line from defendant's transmission main running along the county road, about one mile distant from complainant's house: (2) the construction of a transmission line to connect with the end of the line of the Solano Irrigated Farms at Denverton, a distance of 6/10 miles from the complainant's house.

For the construction of a three-phase, pole top substation and line from defendant's 22,000 volt transmission line under the first alternative, the company estimates a total cost for pole top substation and one mile of three-phase line of $1822.54. This commis-

sion's electrical rate department estimates for the same construction a cost of $1652.10. For a single-phase pole top substation and line in place of the three-phase construction, this commission's electrical rate department estimates a total cost, including overhead expenditures, of $1148.67.

To cover the construction of a single-phase power line from the end of the line of the Solano Irrigated Farms Company to complainant's house, the electrical rate department estimates a total cost of $490.

The following table shows an estimate of total annual cost to defendant if it should be compelled to construct and maintain the line one mile long from its main transmission line to complainant's house, on the theory that a single-phase line is constructed:

	Per Year
Interest on investment at 7 per cent	$ 80.50
Average depreciation (including current repairs) at 7 per cent	80.50
Total fixed charges	$161.00
Meter expense, billing and collecting	9.00
Power cost at ¾c per kw.-hr. taken from transmission line (base rate)	22.00
Total annual cost to company	$192.00

The defendant has offered that if complainant would construct this line the defendant would maintain the same and refund 20 per cent of the monthly bill. The following table shows the result of such an arrangement:

Cost to Complainant:	
Interest on investment	$ 80.50
Annual bill minus refund	57.60
Total	$138.10
Cost to Company:	
Depreciation of line and substation	80.50
Cost of power on transmission line	22.00
Maintenance, billing and collecting	9.00
Total cost	$111.50
Annual bill minus refund	57.60
Approximate annual loss to company	$ 53.90

If complainant installs the extension from the end of the line of the Solano Irrigated Farms Company, as he has been authorized to do by that company, the result will be as follows:

Interest on investment of $490 at 7 per cent	$ 34.30
Depreciation	34.30
Total interest charges	68.60
Estimated average bill	72.00
Total annual cost to complainant	$140.60

Great Western Power Company has hertofore applied to this commission for a certificate to the effect that public convenience and necessity require and will require the service by that company of electric energy to the county of Solano. In securing such certificate, the defendant necessarily held itself out as being ready and willing to serve all of Solano county on terms and conditions which are reasonable. The question in this case accordingly is not whether the defendant is under the duty to serve the complainant or any other inhabitant of this county, but rather under what terms and conditions such obligation should be performed. While it is the general rule that it is the duty of a utility holding itself out as being willing to serve a certain territory, to incur at its own expense the necessary capital expenses and thereafter to serve the applicant at the published rates, there may be cases in which the expenditure necessary to serve would be so large or in which the other conditions would be such as to make it unreasonable both from the point of view of the company and of its other subscribers, to demand that the necessary extension shall be made entirely at the cost of the utility. I am of the opinion that the present case is one falling within the exception rather than within the general rule. It appears that in order to serve complainant from the defendant's main transmission line between Isleton and Napa it will be necessary for defendant to incur an initial expenditure of at least $1148.67, with subsequent charges for operation, maintenance and depreciation, to secure a revenue which will probably not exceed the sum of $72 per year. The evidence shows that there is no reasonable possibility of any other customer being served from the line to complainant's premises. If defendant is to be compelled to serve the complainant in this way, I find that such service should be ordered only on the condition that complainant should pay to the company in addition to his monthly bill, the sum of $9.10 each month for fixed charges on the excess investment necessary to serve him in this way. If complainant is willing to give to the defendant a satisfactory bond to pay this amount for five years from the beginning of service, this commission will make its order directing the defendant to serve him by this route, but otherwise such order will not be made.

From the point of view of the complainant, it would undoubtedly be cheaper to construct a single-phase pole line from the end of the Solano Irrigated Farms Company's line, a distance of some 6/10 miles from his house, at a total cost of some $490. It would be unreasonable to ask the defendant to construct this line, for the reason that the defendant would then find itself in the position of having the lines owned by the Solano Irrigated Farms Company intervening between two portions of its plant. If the Solano Irrigated Farms Company should cease to use its line, the Great Western Power Company would find itself with a piece of its line entirely disconnected from the remaining portions of its system. The company has offered to serve electric energy through the line of the Solano Irrigated Farms Company and the extension thereof to the complainant's house, provided complainant will, at his own cost, construct such extension. If the complainant is willing to adopt this alternative and if he finds the defendant unwilling to serve him through such line, he may draw the matter to the attention of this commission, whereupon the necessary order will be made.

If complainant is not willing to adopt either of the above alternatives, the defendant should repay to him, as provided in its offer to satisfy, the sum of $200 which complainant has expended in wiring his house, provided that the complainant shall repay to the defendant said sum when electric energy shall be furnished to the complainant, either by the defendant or by any other central station company. The defendant should also reconvey to complainant the right-of-way which complainant heretofore deeded to the defendant in the expectation that he would receive service thereover from the defendant. The property was deeded without any payment on the part of the Great Western Power Company and that company certainly should not retain the property while refusing to serve complainant over this right-of-way.

It should be distinctly understood that this commission does not approve the apparently growing tendency on the part of public utilities in this state to refuse to make extensions unless the proposed customer pays for the extension. A very usual arrangement to which this commission's attention is being frequently directed, is an arrangement by which the consumer pays for the cost of the extension and is reimbursed in the amount of 20 per cent, or some similar amount, of his bill month by month. Ordinarily this commission will not approve of such an arrangement. Unless an exceptional case is presented, the commission will adhere to the general principle to the effect that it is the duty of a public utility to build at its own expense all extensions which are necessary to serve persons residing in territory which the company either by direct assertion or by necessary inference holds itself out as ready to serve.

In the present case the general rule is not applied for the reason that it seems clearly to be a case of an exception to the general rule, in which it would be unfair to the utility and to its other customers if it were compelled to incur the large expenditures hereinbefore referred to for the purpose of securing a maximum revenue of only $72 per year. In this connection attention should be drawn to the fact that the company has served no one from its high transmission line for a distance of more than 20 miles, excepting in the case of the Solano Irrigated Farms Company, who have built their own distributing lines, and that if a line is built to serve the complainant, there is no reasonable anticipation that this line may be used to serve anyone else.

In conclusion, it should be understood that each case of an asserted exception to the general rule of the duty of a utility to make extensions at its own expense must be clearly proved before this commission will authorize a deviation from the general rule.

I submit herewith the following form of order:

Order.

A public hearing having been held in the above entitled proceeding and the case having been submitted, and being now ready for decision.

It is hereby ordered as follows:

1. Defendant shall construct a pole top substation and a single-phase pole line, complete with transformer and meter, from its main transmission line between Isleton and Napa, a distance of approximately one (1) mile, to serve the complainant in this proceeding, and shall thereafter serve him with electric energy for lighting, heating and power purposes, but only on condition that complainant shall first have executed and delivered to defendant a satisfactory bond agreeing to pay to defendant each month for a period of five (5) years, whether he uses electric energy or not, the sum of nine dollars and ten cents ($9.10) in addition to his monthly bill at the established rates. If the parties cannot agree with reference to the sufficiency of the bond, the matter may be referred to this commission.

2. If complainant, at his own expense, constructs a single-phase pole line from the end of the Solano Irrigated Farms Company's line near the village of Denverton to his house, defendant shall thereafter serve him with electric energy through the line of the Solano Irrigated Farms Company, in accordance with that company's offer, and through the line so constructed by complainant, and shall charge for such service the regular rates on file with this commission.

3. If complainant does not elect to pursue either of the foregoing alternatives, he shall so notify the defendant, whereupon defendant, shall, in accordance with its offer to satisfy, on file in this proceeding, reimburse the complainant in the sum of two hundred dollars ($200), this being the amount of money expended by complainant for material and labor incident to the wiring of complainant's house in preparation for the reception of electric energy, provided that complainant shall repay said sum to the defendant if electric energy is hereafter supplied to complainant either by the defendant herein or by some other central station company.

4. Within thirty (30) days from the date of this order, complainant shall notify this commission and the defendant as to which of the foregoing alternatives, if any, he desires to pursue.

The foregoing opinion and order are hereby approved and ordered filed as the opinion and order of the Railroad Commission of the state of California.

THE TRANSISTHMIAN DUCT LINE.

The study of the engineering features covering the transisthmian duct line has now been completed, and it has been decided to lay a 4-way, vitrified clay duct line from Colon to Balboa, to contain the signal cable and the telephone-telegraph cable. One duct is available for lease or rental, and the other spare duct is left for future requirements.

The duct will follow the line of the Panama railroad. It will be laid on a base of concrete approximately five inches thick, and encased with three inches of concrete on the top and sides.

Manholes will be located according to the theoretical spacing of loading points, which places the manholes every 774 feet. They are to be of the concealed type, and each composed of only three different pieces. The pieces will all be cast at one central point and distributed along the right-of-way. The light weight of the parts and the flat shape of the individual pieces will allow a knockdown shipment to be handled easily, and with a minimum of breakage.

The signal cable will consist of approximately 215,000 ft. of 13 solid conductor and 50,000 ft. of nine solid conductor No. 12, Brown and Sharpe gage.

The telephone-telegraph cable will consist of 257,730 ft., 38 pairs of 19-gage solid conductors, quadded, and 12 pairs of 16-gage solid conductors in pairs. This will offer an increase over the present telephone trunk lines of approximately 30 circuits.

Armored cable will be installed at bridges Nos. 140 and 309, crossing the Gatun and Chagres Rivers.

Specifications and requisitions covering the 4-way multiple duct, the cables, loading coils, and other adjuncts were completed by the telephone and signal department of the Panama railroad on November 17. Work will be started as soon as the duct arrives on the Isthmus. Duct will be laid at the rate of 1500 ft. per day.

LETTER TO THE EDITOR.

Suit Against Forest Service.

To the Editor:—Under the heading, "Suit Against the Forest Service," on page 214 of your issue of September 6, is an item which makes it appear that the Forest Service objects to hydroelectric development. You state in that item that the Forest officials "are opposed to the construction of the proposed aqueduct through a section of the forest reserve."

The Forest Service does not object to the construction work which the company is doing or to the flooding of National Forest lands for reservoir purposes, provided only that the company will comply with the requirements of the law under which such use of National Forest lands may be permitted. This the company has so far declined to do, claiming that the Act of February 15, 1901, under which a permit might be secured is unconstitutional. The Forest Service therefore has not even had the opportunity to pass upon the question of the permit for the construction work which the company contemplates.

I know the fairness of the Journal of Electricity, Power and Gas in questions relating to power development upon public lands and I should be glad to help you with full information which gives at least the Forest Service point of view. It seems to me in the present instance that the information upon which your news note was based was incomplete and that a statement of the government's side of the question would have carried additional value to the reader. The essential facts with respect to this case are as follows:

The Pacific Gas & Electric Company has maintained for several years a small storage reservoir on the South Fork of the Yuba River in Nevada county, California, and within the boundaries of the Tahoe National Forest, known as Lake Spaulding. It is understood that this reservoir was built about 1892 by the South Yuba Water Company, a corporation organized in 1880 for the purpose of supplying water primarily for mining operations. On account of legislation prohibiting hydraulic mining on certain streams, the company extended its canal system to supply water for the irrigation of the foothill fruit lands in Nevada and Placer counties. Certain members of the South Yuba Water Company, on January 6, 1895, organized the Central California Electric Company for the purpose of utilizing the power drops which existed along the canals. The first power plant was begun at Newcastle in 1895, and the following year electric power was transmitted to Sacramento. This plant had a capacity of 1070 horsepower. Shortly afterward a second plant of 1340 horsepower was built at Auburn, and in December, 1901, a third plant of 4000 horsepower capacity was put into operation at Alta.

On December 4, 1901, the California Gas & Electric Corporation was incorporated and took over, among other companies, the Central California Electric Company. On October 11, 1905, the Pacific Gas & Electric Company was incorporated as a holding company to acquire the capital stock of the California Gas & Electric Corporation and the San Francisco Gas & Electric Company. Since January 1, 1906, the Pacific Gas & Electric Company has operated all the properties of the companies which were taken over by the California Gas & Electric Corporation, and at the present time owns in absolute fee all the properties which it operates. These are, substantially, the steps by which the title to Lake Spaulding passed from the South Yuba Water Company to the Pacific Gas & Electric Company.

The Lake Spaulding reservoir as originally constructed had a capacity of about 6000 acre ft. and occupied an area of about 216 acres, all of which is owned by the Pacific Gas & Electric Company. On account of the necessity of providing additional storage and of constructing a new aqueduct for the proposed Bear River development, the company made plans for the construction of a new dam across the South Yuba River a short distance below the original dam. The new dam when constructed will form a reservoir having a capacity of 92,000 acre feet and will flood about 800 acres. Of this area some 55 acres in the SW. ¼ of Sec. 10, T. 7 N., R. 12 E., M. D. B. & M., are vacant public land within the Tahoe National Forest. The line of the proposed aqueduct will cross for some 1300 ft. vacant public lands within the Tahoe National Forest in Sec. 2, T. 16 N., R. 11 E., M. D. B. & M. Also in the same section, but outside the National Forest boundary, the aqueduct will cross some 3000 ft. of land which the company claims to own but which the records of the General Land Office show to be vacant public land.

By Act of Congress approved May 14, 1896 (29 Stat., 120), the Secretary is "authorized and empowered, under general regulations to be fixed by him, to permit the use of rights of way to the extent of twenty-five feet, together with the use of necessary ground, not exceeding forty acres, upon the public lands and the forest reservations of the United States, by any citizen or association of citizens of the United States for the purposes of generating, manufacturing, or distributing electric power." The Act of February 15, 1901, (31 Stat., 790), repeats the provision of the earlier act and, in addition, gives the secretary authority to issue permits in certain National Parks in the state of California. Regulations under the earlier act were issued by the Secretary of the Interior in July, 1906, and under the later act at various times by both the Secretary of the Interior and the Secretary of Agriculture—by the latter for public lands within the National Forests, and by the former for such lands outside the National Forests.

The officials of the Pacific Gas & Electric Company claim that in so far as the regulations above mentioned require the company to secure a permit before entering upon lands of the United States, such regulations are in violation of the acts of Congress under which they are issued and of the constitution of the United States. A somewhat similar claim was advanced by the Utah Power & Light Company in a suit involving lands of the United States on the Cache National Forest in Utah. The Utah company, however, had constructed its works upon the public lands prior to their inclusion within a National Forest, and its plant was in operation at the time the suit was instituted. The company claimed that its rights had vested under the Act of July 26, 1866 (Rev. Stat. Sec. 2339) and that its tenure of the public lands was authorized and protected under the laws of the state of Utah. The case went on appeal to the United States

Circuit Court of Appeals for the Eighth District. In an opinion filed November 14, 1913, the court says:

The proposition that absolute and perpetual rights in the public lands may be acquired for private gain by mere appropriation, without purchase or compensation, and in the exercise of a state sovereignty which transcends the constitutional power of the congress, is a somewhat startling one. * * * * * The constitution of the United States provides that "Congress shall have power to dispose of and make all needful rules and regulations respecting the territory or the property belonging to the United States." This is the supreme law of the land and embodies an express grant of power to the national government. It has been construed to mean that title and rights in and to the public lands are created by the acts of congress, and must be governed by their provisions whether they be hard or lenient, and that no rights whatsoever can be obtained in the lands of the United States except as congress may consent.

The opinion further holds that the Act of May 14, 1896, and the rules and regulations promulgated thereunder, by making specific and comprehensive provisions respecting a subject such as the generation and distribution of electric power, withdraw that subject from the operation of the prior Act of 1866, saying:

The result is that whatever rights to burden the public lands may have been recognized or confirmed by Section 2339 of the Revised Statutes, those involving the generation, manufacture, and distribution of electric power have been withdrawn, modified and restricted by the subsequent act of May 14, 1896. This later legislation became effective prior to the initiation of appellee's claim. The power company has not availed itself of the provisions of this later statute; therefore, its rights, if any, are subordinate to those of the government.

On September 26, Mr. Britton, vice-president and general manager of the company, appeared before the secretary in Washington to ask for a waiver of the regulations and for permission to construct under stipulation and without formal permit, pending a legal determination of the rights of the government. He claimed that there was immediate necessity for the construction of the aqueduct and that if his request was not granted it would be impracticable to complete the aqueduct before next year. After full consideration the secretary denied the request on the grounds that it was not proper to allow the Pacific Gas & Electric Company to occupy National Forest lands on terms different from those under which such lands were occupied by other applicants; that, had it desired the company could long ago have secured permit and even now could in a short time prepare an application under the regulations of the department; and that if it declined to do so, the company and not the government must assume the responsibility for any delay in the completion of the power project.

The company has long known that it could not be allowed to occupy National Forest lands without a permit. As early as the spring of 1912 the company, through Mr. Wise, took up informally with the chief engineer of the Forest Service, then stationed at San Francisco, the matter of application for a permit to occupy the National Forest land which would be flooded in the enlargement of Lake Spaulding and which would be crossed by the proposed Drum Aqueduct. The company was also formally notified in August, 1912, by the Forest Supervisor that its proposed occupancy of National Forest land would necessitate the securing of a permit. Although the necessary application might have been prepared in a month's time the company preferred not to do so, but instead, somewhat over one year later, namely, on August 26, 1913, filed a suit in equity in the district court for the northern district of California asking that the court restrain the Secretary of Agriculture and the officials of the Forest Service from preventing the company from occupying and using the lands of the United States without permit.

Under the provisions of existing law as interpreted by the highest court that has yet passed upon it, neither the officials of the Forest Service nor the Secretary of Agriculture have authority to allow the Pacific Gas & Electric Company to flood the lands of the United States in section 10 or to cross those in section 2 until it has secured a permit in conformity with the general regulations of the department.

F. S. GRAVES, Forester.

[Aside from a few errors as to early historical data Forester Graves makes a complete statement as to the Government's side of the question. From the company's side it is only fair to add that their main reason for not securing a permit is their thought that such action might give a perpetual option for governmental purchase of their entire system. This communication has been published because of our invariable practice of trying to present both sides of a disputed point. Further comment from our readers will be welcome.—The Editors.]

The record of Panama Canal work from American occupation until Dec. 1, 1913, shows a total excavation of 213,904,031 cu. yds. and a total amount of concrete in locks and dams of 2,890,012 cu. yds. in addition to 25,950,894 cu. yds. of fill in the dams. This has been done at a total cost of $307,385,800.

CENSUS FIGURES ON ELECTRIC LIGHT AND POWER.

Preliminary figures of the forthcoming quinquennial report on the central electric light and power stations of several states have been given out by Director W. J. Harris of the Bureau of the Census, Department of Commerce. The statistics relate to the years ending December 31, for 1912 and 1907, and June 30 for 1902, and cover both commercial and municipal electric plants. They do not include electric plants operated by mining companies, factories, hotels, etc., which consume the current generated, those operated by the Federal government and state institutions, or plants that were idle or in course of construction.

The figures as presented for Arizona show that during the decade 1902-1912 there were substantial gains in the industry. In the case of the aggregate income of the 16 establishments reported in 1912 there was a gain of $879,166 over 1902, or 300 per cent. There were also large gains in total horsepower reported, the kilowatt capacity of dynamos, and the output of stations in kilowatt hours.

Arizona.

The figures in detail are shown in the accompanying table:

	1912.	1907.	1902.	Per cent of increase 1902-1912.
Number of establishments	16	15	13	23.1
Commercial	16	15	13	23.1
Municipal	.....	.....	.....	....
Income	$1,172,232	$569,850	$293,066	300.0
Light, heat and power	$1,127,908	$544,192	$288,019	291.6
All other sources	$44,324	$25,658	$5,047	778.2
Total expenses, including salaries and wages	$923,258	$464,350	$240,953	283.2
Total number of persons employed	217	148	86	152.3
Total horsepower	22,075	7,746	2,540	769.1
Steam and gas engines (including turbines):				
Number	33	33	27	22.2
Horsepower	12,775	6,906	2,540	403.0
Water wheels:				
Number	4	4	.....	....
Horsepower	9,300	750	.....	....
Auxiliary engines:				
Number	(1)	2	.....	....
Horsepower	(1)	90	.....	....
Kw. capacity of dynamos	14,756	4,939	1,811	714.8
Output of stations, kw.-hr.	32,960,084	9,392,302	3,662,045	800.0
Estimated number of lamps wired for service:				
Arc	686	[2] 754	295	132.5
All other varieties	136,400	[2] 72,028	36,556	273.1
Stationary motors served:				
Number	741	339	432	71.5
Horsepower capacity.	12,547	2,220	714	....

[1] Not reported separately.

[2] Exclusive of 17 arc and 857 lamps of other varieties reported by the electric companies as used to light their own properties. Lamps used for such service were included in the number reported for 1912.

New Mexico.

The figures as presented for New Mexico show that during the decade 1902-1912 there were substantial gains in the industry. In the case of the aggregate income of the 21 establishments reported in 1912 there was a gain of $360,351 over 1902, or 266 per cent. There were also large gains in total horsepower reported, the kilowatt capacity of dynamos, the output of stations in kilowatt hours, and in the number of stationary motors served.

The figures in detail are shown in the accompanying table:

	1912.	1907.	1902.	Per cent of increase 1902-1912.
Number of establishments	21	15	11	90.9
Commercial	18	15	11	63.6
Municipal	3	.....	.....	....
Income	$495,658	$292,682	$135,307	266.3
Light, heat and power	$486,185	$289,962	$133,747	263.5
All other sources	$9,473	$2,720	$1,560	507.2
Total expenses, including salaries and wages	$449,516	$226,937	$102,201	339.8
Total number of persons employed	158	83	45	251.1
Total horsepower	11,015	4,548	1,780	518.8
Steam and gas engines (including turbines):				
Number	41	26	21	95.2
Horsepower	10,198	4,035	1,730	489.5
Water wheels:				
Number	9	6	1	800.0
Horsepower	817	513	50	....
Kw. capacity of dynamos	7,981	3,789	986	709.4
Output of stations, kw.-hr.	9,027,824	4,614,349	2,637,810	242.2
Estimated number of lamps wired for service:				
Arc	377	[1] 332	272	38.6
All other varieties	112,207	[1] 55,379	22,507	398.5
Stationary motors served:				
Number	639	195	75	752.0
Horsepower capacity	4,084	1,231	100	....

[1] Exclusive of 2 arc and 506 other varieties of lamps reported by the electric companies as used to light their own properties. Lamps used for such service were included in the number reported for 1912.

VALUATION OF WATER POWER SITES.

BY RUSSELL L. DUNN.

(The author compares o Supreme Court rule for evaluating railroad sites with the Interior and Agriculture departments method of valuating water power sites and draws some interesting conclusions. The article is abstracted from a pamphlet entitled "A Dissertation on Mining Law.")

A water power site comprises the land on which are erected the water power works, dams, reservoirs, canals, pipe lines, power houses, etc., of an actual water power development. This land when the water power development is made has precisely the same relation to the water power business that the land on which the rails of a railroad are laid, and on which its depot and other structures are built, has to the railroad business. There is absolutely no difference in the relation.

In the case of the railroad, the land on which the rails are laid and the buildings erected—the railroad site—is worth just its present value as land—worth what a similar tract of land alongside of it is worth. The United States Supreme Court said this was the rule of worth or value for the railroad site land in the Minnesota rate case. The department of commerce is bound by this rule and will employ it in valuing the physical property of the railroads of the United States. But in the case of the so-called water power sites the interior and agricultural departments do not value them at present worth as land, but value the land by the earning power of the developed water power, which is the same as if the railroad site land were valued by the earning power of all the traffic over the railroad.

If water power site lands in the unsettled mountain territories of the western states be valued by the rule of present value, the same as are railroad site lands, they are worth no more than their price to settlers on them, whether the settlers be miners, farmers or stockmen—from $5 an acre down to $1.25 where it is the public land. That, however, is for the actual water power site land—the comparatively small areas which bear existing structures of water power works. It is not the value for the public lands which have been classified as water power site land and so reserved. These lands, classified as water power sites, are not really water power site lands at all, for there can be no water power site land without an actual water power works on it. Dream water power works are built on dream land sites, not on real land sites.

The classified public lands reserved as water power sites are almost wholly subdivisions which include water courses—creeks, river and lakes. Their reservation blocks the diversion of the water for water power or any other use. That, indeed, is the real purpose of the reservation—the blocking of private enterprise in water power development. Federal officials could not hold up water power development directly for want even of color of authority of law, so they do it indirectly by reserving the land which included the water on pretense that it is water power site land—incidentally excluding mining occupancies and purchases on the pretense of the greater value of the land for water power site purposes.

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Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advanace of date of issue.

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The Corporation with a Soul

The "soulless corporation" is soon to be a thing of the past. so far as the public service corporation is concerned. No matter what the impelling motive that may bring about this change, whether it be due to public policy or private profit, the public service corporation must now realize that a soul is an essential part of its corporate life in serving the public. People know that every corporation has a head, but they usually see only its stomach. When they believe that it has a soul they will give it their confidence.

Consequently every official and employe of a public service corporation should learn what the soul is. Today it is not the hazy thing it used to be. While its exact nature may not be known, yet, like electricity, a satisfactory practical meaning can be learned from its effects.

The dictionary defines soul as a "spirit connected with a body or material organization." So a corporate body, such as a corporation, with the proper spirit has a soul. A more precise definition is given by Gerald Stanley Lee in his new book on "Crowds," "a man's soul is the faculty in him for seeing the whole in relation to the part—his vision for others in relation to his vision for himself." But is not this the very object of true public service and should not this spirit, or this faculty, be the actuating impulse in every public service corporation?

Regard the corporation soul as the sense of proportion concerning the rights of others, let it combine the ideal of the service of all men by all other men with the conception of the value of the individual; express this spirit as an active working principle in all business dealings, and the corporation will attain the highest pinnacle of success, "the science of being believed in."

Procrastination or Education

Though somewhat tardily, the central station industry has been awakening during the past few years to the necessity for educating its employes. Two years ago at the Seattle Convention of the National Electric Light Association, and the idea was by no means new then, a paper was presented on this subject and a recommendation made to the executive committee that a committee on education and instruction of employes be appointed. Such a committee—naturally with the implied work it might accomplish—was considered an urgent need.

Not alone is the central station interested in the success of its employes, though it makes for improved service with the consequent satisfaction to consumers. The whole electrical industry now realizes that the success of the central station employe and especially that of the central station salesman, is of economic importance to all. Their effort in selling electric service creates prospective customers for other commodities.

A committee on Education of Salesmen has been appointed by the N. E. L. A., and if the report of their meeting in the December issue of the Bulletin is correct, it would appear that they have a poor opinion of their own importance. Although in the

second year of its activities, this committee has decided to question the wisdom of their appointment by asking in effect the question, "Are we necessary to you?"

It has decided to confine its efforts, as the year's work, "to ascertain, through a circular letter to all Class A members of the Association whether or not they desire to institute educational work on behalf of their employes."

Their action, in view of the known facts, savors of procrastination and will generally prove disappointing to the employes. Further discussion is a poor substitute to offer for that which for years past has been admittedly desirable.

The committee further states that it wishes to know how best it can serve its Class A members, that it may proceed along the lines which would then seem best.

Central station employes, especially the growing number of those untrained, wish to know the substance of that education which will contribute most to their advancement and the manner in which it may most readily be acquired. They tire of hearing it said that, "We must do something," and suggest instead, on the assumption that half a loaf is better than no bread, that something be tried out.

Why not call a halt to both question and theory and get action, that whatever doubts exist may thus be rapidly removed.

Noteworty Service Connection Decision

An interesting decision on connections for electric service of vital importance to central stations has recently been rendered by the California Railroad Commission. Through the commission pressure was brought to compel a central station to connect to its system the premises of a prospective consumer situated about one-half mile from high tension lines operated by the company.

Because the high tension right of way was expected to cross this prospect's property close to his buildings an application for service connection was taken by one of the company's salesmen.

This signing of an application was not considered by the commission as a binding contract as it was specifically worded that it must first be accepted by the manager of the company. This had not been done.

Later the proposed right of way could not be secured and one much farther away was followed.

The commission held that it would be unreasonable to expect the company to build a line across the prospective consumer's property to the nearest point at which energy was available. This attitude was adopted in view of the fact that this nearest point was a privately owned transmission line operated by the company. Should the owners dismantle or disconnect their system the company would then be in the untenable position of having two parts of its distribution system isolated.

Fundamentally the consumer should be required to bring out his service for connection at that point on his property nearest the supply company's lines—actual or located. This would dispose of similar questions not only automatically but equitably.

Some rate-making bodies have ruled that all service connections must be made by the central station, when the point to which service is to be connected is within a certain distance from its primary lines. But on account of the rapid development of some sections and impossibility of securing business in others, such hard and fast rules may work a hardship in both directions.

In acquiring a certificate of public convenience and necessity the central station either specifically or impliedly expresses its readiness and willingness to serve the whole territory designated. In view of this, the commission requires, as a general rule, that central stations shall make all extensions necessary to supply the people in their territory. But the commission has established the principle that no customer be served at a loss to the company as such losses have to be borne by other consumers, and it therefore follows that there must be exceptions to the general service connection rule.

The commission goes on record as being opposed to the growing practice of charging for extensions even where the charge is rebated to the consumer as a special discount from the regular bills.

On account of the anticipated service the prospective consumer had wired his premises for lights, and for electric cooking and power, at a cost of $200.

In the event af failure to connect its service the commission therefore ordered that the company refund the $200, until such time as the consumer should be served electrically, either by the company or some other central station. Just what would happen if the consumer installed a small private plant is not stated, but from the wording of the order it appears certain that the company would unfortunately forfeit its refund. This error of omission appears to constitute the only unfair possibility of this finding and probably arises out of the wording of the company's offer of settlement.

The commission pertinently points out that the central station company's annual cost to serve this consumer would be approximately $192 in return for which a revenue of $72 might be expected, leaving an annual loss of $120. On this basis, in the event of the company extending its service, the commission ordered that the consumer then give a sufficient surety to guarantee to the company a revenue of $9.10 per month for a period of five years, as a readiness to serve charge to be added to the regular schedule of rates to be paid for all energy consumed.

The complete finding is a further indication that such matters entrusted to public service commissions receive proper consideration; that they are settled more equitably than if handled solely by the interested parties—always of course with the proviso that the commission be appointed for that purpose and with proper reference to the ability of its members and that it is not "political" in the sense that its existence depends upon pandering to the public.

In this case the central station was accorded more just treatment than it had actually sought. A possible loss was averted. This, together with other facts as stated, is additional proof that the work of public service commissions serves to stabilize public utilities.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

L. P. Judd, manufacturer of the Judd Washing Machine, was in Salt Lake City last week.

W. S. Gilman Jr. has resigned from his position with the Southern California Edison Company.

Frank Somers, electrical contractor of San Jose, was at San Francisco during the past week.

W. F. Neiman, sales manager, Great Western Power Company, is on a business visit to Oregon.

G. L. Drennan has been appointed local manager Pacific Power & Light Company, Toppenish, Wash.

H. E. Sanderson, Pacific Coast manager Bryant Electric Company, is making a business trip to Seattle.

J. A. Greer, Railroad & Railway Supply Company, New York City, spent the past two weeks at San Francisco.

A. J. Dahleen, salesman Electric Appliance Company, has resigned and will engage in the insurance business at San Francisco.

Harry J. Pieper, Los Angeles, has been appointed on the membership committee of the Electric Vehicle Association of America.

A. J. Cheney will shortly join the electrical department staff, H. W. Johns-Manville Company, San Francisco, as salesman.

G. A. Wooley, manager detail and supply department, General Electric Company, Denver, was at Salt Lake City last week.

F. N. Cooley, Western Electric Company, San Francisco, has been transferred to a new position at the Seattle office of the company.

C. I. Kephart, commercial engineer, San Francisco & Sierra Power Company, has returned to San Francisco from Southern California.

F. H. Welling, Pacific Coast manager Federal Sign System, left this week for a two weeks' business trip through the Pacific Northwest.

Robert E. Wirsching, recently appointed to fill the unexpired term of **O. O. McReynolds** on the board of public utilities, has been reappointed.

J. O. Presby, salesman Holophane Works of General Electric Company, was at San Francisco over the holidays and has now left for a trip throughout Southern California.

G. I. Kinney, Pacific Coast manager for the Fort Wayne Electric Works and Sprague Electric Works of the General Electric Company, spent the past week at Los Angeles.

Sherman M. McFedries, manager controller sales, The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., is at San Francisco and will leave shortly for Los Angeles.

Frank McNabb has succeeded **J. E. Baxter**, and **C. G. Wallney** and **F. C. McLaughlin** have joined the staff in the anditor's department, Southern California Edison Company.

Melcher Eckstromer, electric vehicle engineer of Denver, Colorado, is at Salt Lake City in connection with the establishment of an agency with the Capital Electric Company for the General Motors Company's line of trucks.

Wilbur B. Foshay has severed his connection with the Northwestern Electric Company of Portland, Oregon, and is now connected with the Washington Public Service Company with offices at 1015 Wilcox building, Portland, Oregon.

W. Brewster Hall, western representative, Pass & Seymour, left San Francisco last Monday for an extended trip East by way of Los Angeles, Salt Lake City to Chicago, and will return via Spokane and Seattle; while away he will also visit the company's factory.

Glenn B. Walker, commercial engineer of the Utah Light & Railway Company, is spending the holidays at his home at Benton Harbor, Michigan. While away, he will visit friends at Pittsburg, where he spent two years in the apprenticeship of the Westinghouse Electric & Manufacturing Company.

Henry O. Lea, consulting gas engineer, Chicago, is representing Henry L. Doherty & Company, owners of the gas plant at Lincoln, Nebraska, in the gas rate hearing case to be resumed this month and is also representing the United Gas Improvement Company, in the Omaha (Neb.) gas rate hearing case.

E. J. Pietzcker, formerly southwestern sales manager, has been made western and southwestern sales manager in charge of the Chicago and St. Louis offices of the Standard Underground Cable Company, the combined territory of which, broadly speaking, embraces the Mississippi River Basin. He will divide his time between these two offices. **W. M. Rogers**, formerly chief clerk and assistant to Mr. Wiley, is appointed assistant western sales manager with headquarters at Chicago. **R. C. Houck** has been appointed assistant southwestern sales manager with headquarters at St. Louis. **E. E. Woodbury** is added to the selling force of the St. Louis office and is transferred for that purpose from the general sales department of the company at Pittsburgh.



Chas. F. Reuter has been appointed manager of the Pacific Coast district with the Ideal Electric & Manufacturing Company of Mansfield, Ohio, succeeding **R. B. Elder**, who has resigned this position to be active with his mining interests on the Mother Lode. Mr. Reuter is one of the pioneers in the engineering, machinery sales and electrical trade on the Pacific Coast, and many important enterprises are monuments to his achievements. He has made many friends among the engineering and machinery trade. His competency, close attention to his business and congeniality have made him successful and popular with the trade. Both the Ideal Electric & Manufacturing Company and Mr. Reuter should be congratulated on forming such a splendid combination.

OBITUARY.

Warner Van Norden, a retired banker of New York City, died at his home in that city on January 2d, at the age of 72 years. Mr. Van Norden at one time had large mining and water interests in California. In 1872 he became interested with the late Mr. Alvinza Hayward in the Plymouth Consolidated mine in Amador county. Through the same connections Mr. Van Norden and some of his New York associates became interested in the South Yuba Water & Mining Company in Nevada county and eventually bought the control of that company. As principal stockholder he allowed this property to develop gradually, adding thereto the property of the Bear River and Auburn Mining & Water Company which supplied water in Placer county. With this combination was formed the South Yuba Water Company. In 1895 a subsidiary company was formed known as the Central California Electric Company to develop hydroelectric power on the canals of the parent company. This power was transmitted throughout Placer county and into Nevada and Sacramento counties. This entire property was acquired by the Pacific Gas & Electric Company in 1905 and now forms the basis of the new Lake Spaulding power development now partially completed and from which it is proposed to generate 165,000 horsepower and eventually irrigate 100,000 acres of land.

Mr. Van Norden was of Dutch and Huegenot descent

and was a past president of the Holland society in New York. He was at one time president of the National Bank of North America and later organized the Van Norden Trust Company. In secular matters he was a devoted Presbyterian and one of the foremost advocates of the American Foreign Missionary movement.

He was a brother of the late Charles Van Norden, who was resident director of the South Yuba Water Company, and General Manager of the Central California Electric Company, until his retirement from active business duties in 1905, and who died at his home in Auburn, California, in May of last year. He is survived by two sons and one daughter. Rudolph W. Van Norden, consulting engineer of San Francisco, is a nephew and namesake.

MEETING NOTICES.

Inspection of Diesel Motor Ship "Siam."

Those engineers who desire to inspect the Diesel motor ship "Siam," now in San Francisco harbor, can make arrangements to do so by telephoning to this journal at Kearny 918, San Francisco. Parties will be welcomed on January 10th and 11th.

California State Association Electrical Contractors.

At the annual meeting of the California State Association Electrical Contractors held recently at San Francisco, C. F. Butte was re-elected president; Nelson Hope, vice-president; Geo. Smith, sergeant-at-arms; W. S. Hanbridge was re-elected secretary-treasurer.

San Francisco Electrical Development and Jovian League.

The Jovian Order was in charge of the regular meeting held at Tait's Cafe last week when F. H. Poss acted as chairman. Routine business was conducted and reports of committees read. P. B. Hyde, chairman membership committee reported that 25 applications had been received for the Rejuvenation to be held at Elks Hall on Saturday evening, January 10th. There are 75 more expected to be received before that time. Details were given of the entertainment to be given and all arrangements pointing to a successful Rejuvenation were completed.

Capital Electric Company Convention.

The Capital Electric Company held its semi-annual convention at Salt Lake City during the last week in December. Approximately 150 men from the three states of Utah, Idaho and Montana, representing thirteen branch houses, took part in the discussions. The convention ended with a banquet at the Hotel Utah on the evening of December 30th. R. W. Nicol, president and general manager of the Capital Electric Company, officiated as toastmaster. The managers of the various branch houses in attendance at the banquet were: L. H. Allen and R. E. Allen of Helena; C. H. Pitts, Billings; L. N. Baker, Missoula; H. A. Murphy, Butte; A. C. Probst, Great Falls; I. L. Buse, Boise; A. W. Hill, Twin Falls; H. Schafer, Pocatello; W. J. Bauchman, Idaho Falls; L. I. Hurdy, Ogden; Roy Borne, Provo; Harry Clyse, Price; Robert Folland and Claude Kugler, Salt Lake City.

TRADE NOTES.

The Decker Electric Company has been awarded the wiring contract for the Marshall School, San Francisco.

The Warman Steel Casting Company, Los Angeles, expect to immediately install an additional electric furnace.

Hobart Building plans are out for wiring estimates; Willis Polk, architects, San Francisco. Tenders are also asked for the installation of an isolated plant for this building.

The Washington Public Service Company is installing an electric and steam heating system at Olympia, Washington. The company owns the Olympia Water Works and also has railroad franchises in Olympia and from there to Tennio, Centralia, Chehalis and Gate, Washington.

Bids for the ornamental street lighting installation on Fifth street at Seattle, Wash., were as follows: Meacham & Babcock, $17,360.02; T. Ryan, $14,117.40; R. E. Downey, $14,105.86; Ne Page, McKenny Company, $14,102.35; Dicken & Rightmire, $12,278.70; Olympia Foundry Company (poles only), $1894.

A motograph electric sign, the first of this kind west of Chicago, is to be erected by the Federal Sign System for the United Advertising Sign & Novelty Company at Seattle, Wash. It will be 30 ft. by 60 ft. and contain 3000 ten-watt sign lamps. The motion mechanism is in the form of a perforated roll similar to that used in player pianos. It will be operated on direct current.

Bids for electrical work on the Horticulture, Education, Machinery Hall, Pure Foods and Manufacturers' Buildings of the Panama-Pacific International Exposition, have been opened and are as follows: Turner Electric Company, $20,600; Rex Electric Company, $18,957; Globe Electrical Works, $18,950; Butte Engineering & Equipment Company, $18,975; Newberry, Bendheim Company, $18,500; Central Electric Company, $17,850; National Electric Company, $17,800; Standard Electric Company, $16,500; H. S. Tittle, $14,104; McFeil Electric Company, $13,080.

A new corporation has been formed and is taking over the plants and business of Milliken Bros., Incorporated. The operating management, which has been responsible for maintaining the company's reputation for character of work and service has been retained, which insures continuance of the quality of the company's work, the prompt service and courteous treatment of its customers. The new company will have one million dollars of quick assets in addition to its real estate, buildings and fixtures. The company's property is free of mortgage lien. Provision has been made for such changes and equipment as will greatly increase the capacity of the fabricating plant. The company is developing both its domestic and export business, and solicits invitations to bid for all kinds of structural steel work.

BOOK REVIEW.

American Electricians' Handbook. By Terrell Croft, 711 pp.; 4x6¾; leather-bound. Published by McGraw-Hill Book Company, New York, and for sale by Technical Book Shop, San Francisco. Price $3.00.

In his preface the compiler states "This is a practical man's book." As a reference book for practical workers it is at once comprehensive and thorough. The text is divided into six sections, treating respectively of fundamentals, generators and motors, outside distribution, interior wiring, transformers and illumination. Little information that any constructing or operating man may be called upon to apply to his work is omitted. The wireman, the contractor, lineman, operator and construction man will find this a veritable encyclopedia. While it makes no claim to the interest of the designer or theoretical man, knowledge of its many points would also be valuable to them.

The Eletcrical Blue Bock, 1913-14; 227 pp.; 9x12 in.; cloth bound; profusely illustrated. Published by Electrical Review Publishing Company and for sale by Technical Book Shop, Rialto Bldg., San Francisco. Price $2.

This is the sixth edition of this buyers' guide of electrical material, and many important features have been added which further increases its value. The aim of the publisher is to provide in the most compact form possible complete information respecting the rules of the National Electrical Code, the list of Approved Fittings as published by the Board of Fire Underwriters, and a visualization of the products of manufacturers which have passed tests recommended by the National Fire Protection Association as conducted by the Underwriters' Laboratories. Among the new features are also chapters on Wiring Calculations, Treatment for Electric Shock, Illumination, A. I. E. E. Code of Ethics, Motor Applications, Rate Analysis, and a Street Lighting Schedule.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The railroad commission rendered a decision denying the application of the Coast Counties Gas & Electric Company for authority to issue 2000 shares of its 6 per cent preferred stock.

A decision was rendered granting authority to the San Dimas Water Company to issue $15,000 of bonds for the purpose of developing additional water supply.

A decision was rendered denying the application of the Tonopah & Tidewater Railroad Company to issue $364,000 of bonds.

The commission rendered a decision reducing the schedule of rates and also wholly revising the schedule of rates of the Sierra Railway Company.

The Southern Counties Gas Company was granted authority to issue $9000 in bonds under a previous authorization.

A decision was rendered reducing the wholesale rate on natural gas piped from the Kern county fields into Los Angeles County from 18 cents per thousand feet to 14 cents per thousand.

The Midland Counties Public Service Corporation was granted authority to issue $79,000 of bonds for the purpose of paying off indebtedness incurred in construction of new lines.

Authority was granted to the Tulare County Power Company to issue $80,000 in stock for enlargements to its steam plant and for the construction of new lines and distribution systems.

A decision was rendered granting authority to the Angel's Flight Railway Company to issue $25,000 of stock.

A decision was rendered granting authority to the Northern California Power Company Consolidated to issue $12,000 of promissory notes.

NEWS OF THE OREGON RAILROAD COMMISSION.

In the matter of prescribing adequate and serviceable standards for the measurement of quality, pressure, initial voltage and other conditions pertaining to the supplying of product and service by public utilties a further hearing will be held before the commission at Room 252, Court House, Portland, Oregon, at 10:15 a. m., the 16th of January, 1914.

MONTANA PUBLIC SERVICE COMMISSION.

Commissioners: D. Boyle, chairman; J. H. Hall; E. A. Morley; R. F. McLaren, Sec.; Oscar Reynolds, chief engineer.

Report and order of the Commission No. 77 regarding alleged excessive rates charged by the Montana Power Company, makes certain adjustments and reductions in certain of the schedules of the Montana Power Company and subsidiaries. "The economies effected by the Montana Power Company by its consolidated management and other factors, probably places that company in a different situation than is presented by some of the cities or towns which are served by independent or separate plants, and therefore this decision is not intended to serve as a controlling precedent in any hearings that may be had affecting such other towns."

For Billings, Bozeman, Butte, Great Falls, Lewiston and Livingston seven schedules are provided. The general rate is based upon 10c per kw.-hr. for 100 kw. or less. An optional "readiness to serve rate" provides $3 fixed charge per year per 60 watts installed plus 5c per kw.-hr. for all current used. Both these schedules provide for free renewals of carbon lamps. Flat rate lighting is provided for on the basis of 1½c per watt per month for all-night service. A discount of 10 per cent for payment within five days is provided for all incandescent lighting bills. A 3c heating and cooking rate is provided with a dollar minimum. An industrial power flat rate of $50 per horsepower year or a sliding scale rate is available.

For 28 smaller towns the general lighting rate is based upon 12c. Other rates are about the same as for the larger towns.

The company will not extend its secondary lines more than 300 ft. from one electric light consumer. Power extensions will be made on the basis of 100 ft. for each horsepower connected.

ORDINANCE REGULATING ELECTRICAL CONSTRUCTION.

With the approval of the superintendent of the Department of Electricity, San Francisco, the building committee of the supervisors recommended for passage a new ordinance governing the sale of electrical fixtures and prescribing the manner in which installations must be made to safeguard against fire and possible loss of life.

One of the most important provisions of the new measure is that dealers in electrical supplies shall keep a record of all sales and require of persons purchasing from them notification when the fixtures or supplies so purchased are installed. This being done, the department of electricity will make an inspection of the work and determine if it has been done in the manner required by the regulations of the department.

The ordinance also provides that instead of a bond being required of contractors engaged in electrical work they shall pay an annual license fee to the city which will pay for inspection. The inspection will be a guarantee that the work has been properly performed and according to the standard required by the rules and regulations of the department of electricity. The measure also provides that instead of specifying any one standard that the best ones shall be recognized by the department in passing upon the character of the work performed. All dealers and contractors in electrical work or supplies must also register their names and places of business with the department of electricity.

NEW CATALOGUES.

(Under this heading attention is directed to catalogues and bulletins representing the latest information upon the subjects treated. The latest developments are always in advance of the most up-to-date text books. Readers are urged to write direct to the publishers for these catalogues and bulletins, which, unless otherwise stated, are available for free distribution.)

The General Electric Company's Bulletin A4171 is devoted to Ventilated Railway Motors and supersedes the company's previous bulletin on that subject.

Bulletin A4173, issued by the General Electric Company, describes the GE-201 Ventilated Commutating Pole Railway Motor, and supersedes the company's previous bulletin on this subject.

The Simplex Electric Heating Company is distributing a leaflet illustrating and describing the Simplex foot warmer rug, an "insurance against cold feet" in the home, office, on board ship, in an electric automobile or wherever electric current is available.

Lead Battery Developments During 1913 for Electric Vehicles are covered in Bulletin No. 142, issued by The Electric Storage Battery Company, Philadelphia, Pa. It is a reprint of a paper presented before the recent convention of the Electric Vehicle Association of America.

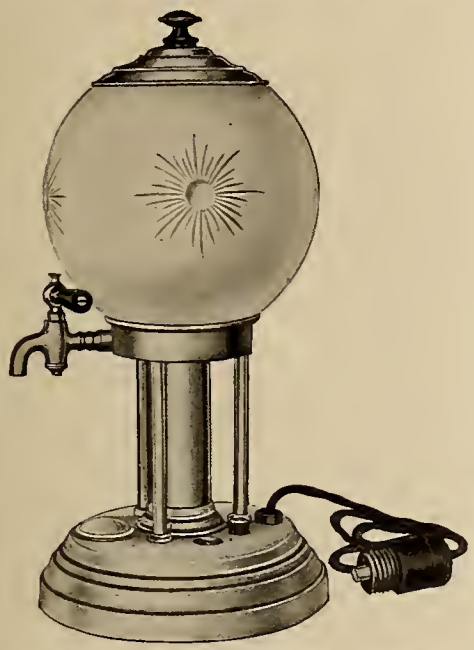
The Bryant Electric Company are distributing to the trade an ingenious device, which conveniently shows the adaptability and interchangeability of their various styles of "New Wrinkle" sockets and bases, together with the list price schedule and standard package. This is accomplished by means of a revolving circle, on whose circumference are pictures of various sockets, rosettes and switches, which can be fitted to various caps and bases illustrated on an outer stationary circle. On the reverse side are also shown interchangeable porcelain sockets and "Wrinklet" fixture sockets.

INDUSTRIAL

A NEW ELECTRIC WATER HEATER.

A 660-watt electric water heater of entirely new design has been added to the line of water heaters made by the Cutler-Hammer Manufacturing Company of Milwaukee. This new heater illustrated below has a water capacity of three quarts and because of its low consumption of current can be attached to any lighting circuit.

For the purpose of guarding against waste of current a small pilot lamp is mounted in the base of the heater, under a ruby glass lens, this serving as a signal light to show when the current is on, and as a reminder to switch it off when the heater is no longer required. A flush switch is mounted in the base, the two buttons of which facilitate the operation of switching on and off the current.



New 660 Volt Electric Water Heater.

These heaters are of particular use in the cooler months in buffets, restaurants and drug stores where used in dispensing hot drinks at the bar or soda counter or for furnishing hot water for any purpose. In the home they are suitable for furnishing hot water instantly for tea, coffee, cocoa, hot drinks, soups, broths, for the shaving mug or any other purpose for which hot water in small quantities is wanted quickly.

The frosted glass globe is decorated with cut glass stars and the base is heavily nickel plated. The heating unit is a new type and can be readily renewed.

TRAIN LIGHTING SYSTEM.

The Electric Storage Battery Company has recently put on the market an axle lighting system for the electric lighting of railway trains, which, in many respects, is a radical departure from previous practice, and involves many novel features. The dynamo, which as usual is mounted on one of the trucks and is belted to a pulley on the axle, is of the Rosenberg type which has been extensively used for axle lighting abroad as a constant current machine. This has been re-designed to give constant voltage (instead of constant current) at all speeds above that corresponding to a train speed of 15 to 20 miles per hour.

In the Rosenberg machine the main field excitation is produced by armature reaction due to current flowing between a pair of short-circuited brushes. This flow of current is produced by a small primary field excitation at right angles to the main field excitation.

The constant voltage characteristic of the machine is obtained by connecting the primary field winding across opposite corners of a Wheatstone bridge; the other two junction points of the bridge being connected across the main terminals of the machine. The bridge is composed of fixed resistances in two diagonally opposite branches and in the other two branches resistances of high temperature coefficient, such as the so-called iron wire "ballasts."

This system eliminates practically all of the automatic apparatus found in other axle lighting systems. The dynamo develops the same polarity with either direction of rotation, and therefore, requires no pole changing device. The Wheatstone bridge field control involves no moving parts or contacts and thus eliminates all of the levers, pivots, dash pots, carbon pile resistances, solenoids and similar apparatus found in other systems. The constant voltage control whereby the voltage of the dynamo is maintained but slightly above the floating voltage of the battery involves so small a range of voltage between battery charge and discharge that no lamp regulator is required, thus eliminating another series of moving parts. The lamps are connected directly to the terminals of the battery without the interposition of any controlling resistance or regulating coils, solenoids, etc., thus eliminating the drop between the battery and lamps which is often found in other systems.

The method of control involved in this system is ideal for battery operation, eliminating all gassing charging, and at the same time recharging the battery rapidly after every discharge. Unnecessary overcharge is avoided and conditions adapted to secure the maximum life of the plates are maintained. Decomposition of the electrolyte in the cells by excessive gassing is prevented, thus reducing to a marked extent the amount of attention required for filling the cells with water from time to time.

When the car is standing there is no discharge whatever from the battery for the excitation of so called teaser coils, or for any other purpose, provided the lights are turned off. The equipment can, therefore, stand for many weeks without the battery losing its charge and can, therefore, be put into service immediately after such a period of idleness without further attention.

The first of these equipments to be put into actual service was installed on a car of one of the western trunk lines in November, 1912, and has been in continuous service ever since. As a result of the operation of this equipment the railway company in question has ordered 62 equipments of this type which are now about to be put into service. During the year of operation of the original equipment there has been no light failure or delay to car service on account of axle lighting equipment, no repairs to dynamo (except replacing of a defective ball bearing; these bearings being smaller than present standard), no removal of dynamo from car, no charging of battery, except that given by axle-dynamo en route, and no change in adjustment of controlling apparatus.

For purpose of test, the battery was completely discharged before leaving Chicago, January 9, 1913, and returned January 12, 1913, practically full, no change having been made in adjustment of controlling apparatus.

Water was added to the cells on the following dates only: November 19, 1912; December 31, 1912; January 15, 1913; August 12, 1913.

NEWS NOTES

ILLUMINATION.

ALAMEDA, CAL.—The electricity commission has decided to install electroliers along Webster street.

SEATTLE, WASH.—The city of Seattle has applied to the county commissioners for a franchise to furnish light and power between Seattle and Auburn.

ALBANY, ORE.—G. W. Hollister, representing Albers Bros. of Portland, was here recently for the purpose of investigating the feasibility of installing a gas plant.

MARTINEZ, CAL.—S. Waldo Coleman has applied to the railroad commission for a certificate of public convenience and necessity to construct and lay down gas mains in Contra Costa county.

HUNTINGTON BEACH, CAL.—The West Coast Gas, Light & Fuel Company has been ordered by the railroad commission to install an additional gas generating unit of at least 10,000 cu. ft. capacity.

PASADENA, CAL.—The commission has granted a certificate of public convenience and necessity to the Los Angeles Gas & Electric Corporation to operate under franchises in South Pasadena.

BEAUMONT, CAL.—The Beaumont Gas & Power Company has applied for a franchise for electric light and power service for Beaumont. The application states that work will begin at once on the service.

NEWPORT BEACH, CAL.—The railroad commission denied the application of the West Coast Gas, Light & Fuel Company to raise its minimum rate of 50 cents to $1.00 per month during certain months in each year.

LOS ANGELES, CAL.—City Electrician R. H. Manahan reported to the board of public works that he is negotiating with the Los Angeles Railway Company on the matter of the cluster lights for temporary relief along the company's lines in outlying districts not properly lighted at the present time.

BREMERTON, WASH.—The city council voted against the proposed ordinance outlining the project of Gustave F. Rust of Colby, appearing for a group of promoters offering to build a light and power plant on the Hama Hama River. They offered to turn the plant over to the city at the end of three years for $350,000.

BELLINGHAM, WASH.—Manager L. R. Coffin of the Puget Sound Traction, Light & Power Company, announced that approximately $8,000 will be expended by the company in improving and modernizing the local gas plant. The work will consist of the construction of a high concrete foundation used in the supporting of the steel holder tank.

LOS ANGELES, CAL.—The board of public utilities expects to announce the natural gas rate immediately. The railroad commission has fixed the wholesale rate at Los Angeles City limits at 14 cents. The problem involves fixing a rate which will be correct for the mixture of natural with artificial gas, as the daily consumption of one of the companies has reached a peak of 19,000,000 cu. ft., and the natural gas supply is insufficient to meet the demand.

TRANSMISSION.

EL CENTRO, CAL.—After a topographical survey of the proposed high voltage transmission line from Banning to El Centro, Engineer R. W. Waterman in charge of the survey, began work from El Centro, and will lay out the exact route where wires and cables are to be put up. When the line is completed it will convey high voltage from the Sierra Power Company's station at Banning to important points in Imperial Valley, with El Centro as the chief distributing station.

LAKEPORT, CAL.—A demurrer of the Yolo Water & Power Company to the complaint in the injunction suit brought by Lake County to restrain the power company from locating on Clear Lake has been filed in the Superior Court. Superior Judge M. S. Sayre of this county is disqualified from hearing the case by reason of property interests. It is expected here the suit will be transferred to another county.

FRESNO, CAL.—The Stone & Webster Construction Company has practically completed operations at Big Creek, and within the next two weeks, it is expected that all the finishing touches will have been made. About 100 men are working there now preparing the company's equipment for shipment out of the mountains. These men are the last of 60,000 who were employed there at different times while the power plant of the Pacific Light & Power Company was under construction.

SACRAMENTO, CAL.—Electrical contracts aggregating $70,442 were awarded by the city commission in accordance with the recommendations of City Electrician G. Stanley Pearce. The Pacific Gas & Electric Company secured the contract for street lighting. The total cost of the lighting for the year will be $66,328. Park lighting will cost $538. The contract for the lighting of buildings, involving $2150, and for electrical power, involving $1431, went to the Great Western Power Company. The contracts went to the same companies for last year at about the same rates.

SALT LAKE CITY.—The completion of the high tension line of the Utah Power & Light Company from Grace, Idaho, to Salt Lake City was celebrated by the officers and employes of the Phoenix Construction Company by a banquet at the Hotel Utah. The dinner was given by J. D. Evans, vice-president and general manager; P. L. Pierce, superintendent of construction; Markham Cheever, chief engineer of the Utah Power & Light Company, and Dr. D. C. Budge, chief surgeon of the construction company. P. J. Moran, one of the directors of the Utah Power & Light Company, was also present as a guest.

TONOPAH, NEV.—The power site reserve recently created by the government in Boulder Canyon is the result of the project initiated here in 1909 by Henry Schmidt and Clement Mayes of Tonopah. The location is such that it can be relied upon to furnish an unfailing supply of energy for an indefinite period, as the watershed takes in the entire mountain country of western Utah and Colorado, where the snowfall always insures a large run-off. Boulder Canyon is the site of the former steamship landing, where freight was brought to Salt Lake and Nevada points in the '50s and the power project will revive what is probably the oldest town in the state. According to the preliminary investigation, it will require an expenditure of $1,900,000 to carry out the plans of the company to deliver electric power at Ely, Searchlight, Las Vegas and Eldorado Canyon, Nev., and Kingman and Chloride, Ariz. The distance to Ely is 240 miles. This is the greatest length of transmission line on the system. Kingman is only 40 miles away, in an air line, and that camp will be materially benefitted as the cost of power has always been a stumbling block to investments and development of local mines.

TRANSPORTATION.

LOS ANGELES, CAL.—The City Council has abandoned the stub end of Fifth street, by ordinance. This removes one of the last remaining obstacles to the immediate construction of a new depot in Los Angeles.

SAN DIEGO, CAL.—The railroad commission has ordered the Los Angeles & San Diego Beach Railway Company to ask the city council of San Diego for extension of the franchise on La Jolla line, then apply for authority to issue bonds to electrify the road.

LOS ANGELES, CAL.—The city council has directed the Pacific Electric Company to remove the center poles and replace same with span wires to carry the trolley wires on Sixteenth street, between Normandie avenue and Arlington avenue, as per ordinance requirements.

LOS ANGELES, CAL.—The Pacific Electric Railway is rapidly superseding steam trains for passenger service on many interurban lines contiguous to Los Angeles. The Southern Pacific has announced its withdrawal of all trains on the Riverside-San Bernardino line and the local lines from Los Angeles to Whittier, Long Beach and San Pedro.

OAKLAND, CAL.—The directors of the Oakland, Antioch & Eastern Railway Company have called a special meeting of stockholders on March 3 to vote on the proposition of increasing the bonded indebtedness of the corporation from $5,000,000 to $5,700,000, and to secure the payment of the additional $700,000 by pledge agreement upon a portion of the bonds heretofore issued.

OGDEN, UTAH.—Commencing with January 1st, the Ogden Rapid Transit Company has purchased power for the operation of their system from the Utah Power & Light Company and their substation on Washington avenue has been remodelled to receive this power. The total amount of power now required to operate the Ogden Rapid Transit Company's system, is approximately 2700 h.p. Power was previously furnished by the Utah Light & Railway Company.

IDAHO FALLS, IDAHO.—It is stated the public utilities commission of Idaho propose to investigate the conditions under which the promoters of an electric street railway line for this city will handle the proposition, as a result of differences which have arisen between the mayor and the promoters of the new line. The commission will determine the amount the promoters expect to receive from the sale of stock, the amount of money that they themselves propose to put into the system, and such other information as may be necessary to protect the public.

SAN FRANCISCO, CAL.—Plans for the extension of the Geary street municipal railroad to the Exposition grounds and other projected points have been announced. Work will begin as soon as possible on the enlargement of the car barns to accommodate 70 more cars, and bids for materials for new track will also be let. Deliveries of material are to begin as early as March 15th and last through until December 15th. The city engineer's plans call for the beginning of work on the various extensions as follows: Van Ness avenue, Chestnut street, April 15th; Potrero avenue, Columbus avenue, June 1st; Fort Mason, August 15th; Stockton street, California street, Church street, September 1st; reconstruction of Union street line, August 1st. The various projects are to be completed all the way from the end of August to the end of January 1915. In this way all projected extensions, reconstruction and enlargements will be completed in plenty of time for the Exposition.

TELEPHONE AND TELEGRAPH.

VENICE, CAL.—The Sunset Telephone Company has agreed to extend its line to Kay Bee camp, in San Ynez canyon. Work is expected to start at once.

EL CENTRO, CAL.—The Imperial Telephone Company will begin construction of a line to Bernice within the next few days, the material already being on the ground.

EAGLE ROCK, CAL.—The railroad commission has granted the Pacific Telephone & Telegraph Company a certificate of public convenience and necessity for operation here.

RIVERSIDE, CAL.—S. D. Kamrar has applied for a certificate of public convenience and necessity to construct a telephone system into the section surrounding Blythe, Riverside county.

MODESTO, CAL.—The Pacific Telephone & Telegraph Company has filed its answer to the complaint of a number of patrons of farmer line telephones in the vicinity of Modesto. The telephone company denies that its rates of service are discriminatory or excessive.

WATERWORKS.

RENO, NEV.—After deliberation lasting since last October, the city council has voted against the adoption of the Frisch ordinance of the Galena creek water proposition.

LOS ANGELES, CAL.—City water service for Lassell Park, Washington Park, Elliott Place and contiguous territory has been assured by the action of the water board, Engineer Mulholland having been instructed to bring in plans for taking over the service in all these localities.

TUCSON, ARIZ.—Bids will be received up to January 26th, by the common council of the city for issue of $165,000 of water improvement bonds. Bonds will be dated January 2, 1914; shall bear interest at 5 per cent per annum. payable semi-annually; will be of denomination of $500 each, and shall run 30 years from date of issue.

ST. JOHNS, ORE.—A petition signed by 92 residents was submitted to the council at a recent meeting asking the council to take steps to construct a municipal water plant with Bull Run water as a supply. According to the petition the council is asked to take steps to lay water mains in the streets of St. Johns and secure from Portland a supply of Bull Run water.

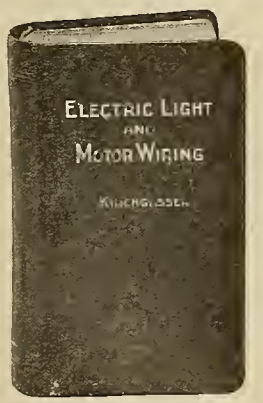
SALEM, ORE.—Pronouncing the water service provided by the Coos Bay Water Company for the cities of Marshfield and North Bend inadequate, the state railroad commission has issued an order directing the company to increase the capacity of its reservoirs and its mains by August 1, 1914. The commission ordered the construction of a reservoir or 1,000,000 gallons capacity, also a 14 in. main to the distributing system in Marshfield, and enlarged mains in the cities themselves.

NILES, CAL.—The election called by the supervisors of Alameda county for the formation of an Alameda County Water District, to comprise sections of Washington Township, including Niles, Centerville, Irvington, Newark, Decoto and portions of Alvarado, resulted in a victory for the district. The purpose of the election was to provide a means of protecting the water supply of that section. Under the water-district plan, a board of directors may be appointed and endowed with authority to take the necessary legal steps to protect the water systems of the municipalities within the district. A further extension of the same plan allows the district to formulate and put into execution an independent water supply sytsem.

SAN FRANCISCO, CAL.—The condemnation suit of the city and county of San Francisco against the Spring Valley Water Company was begun last week in the Superior Court. This is said to be the most important condemnation suit ever instituted. The amount and value of the properties to be taken breaks all records of litigation of this character. All of the judges who are to sit in this case will come from counties outside of the Appellate Court district, of which San Francisco forms part. At least one of the three is to come from the southern section of the state, it is said, while one or two will be from the northern or the central part of California. Attorney Haven says that, while the suit will be brought to trial as soon as possible, it will take from three to six months to prepare for the hearing, and the taking of evidence may not be commenced until about the middle of the year.

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VOL. XXXII NO. 3 SAN FRANCISCO, JANUARY 17, 1914 PER COPY, 25 CENTS

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BY J. C. STEVENS.

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BY JOHN S. EASTWOOD.

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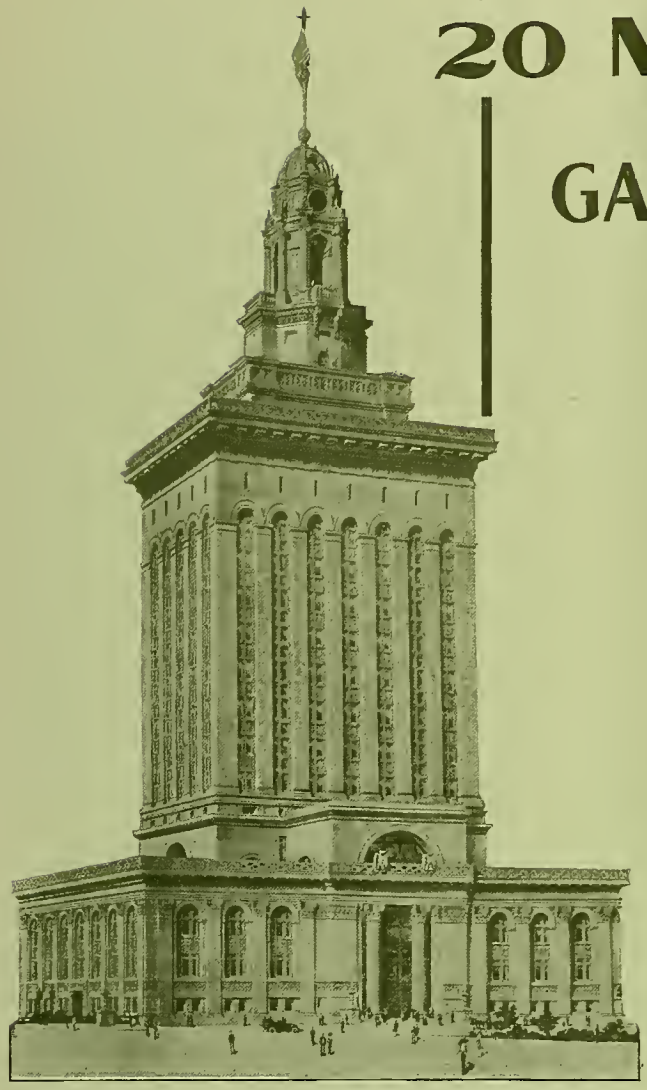
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JOURNAL OF ELECTRICITY
POWER AND GAS
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VOLUME XXXII SAN FRANCISCO, JANUARY 17, 1913 NUMBER 3

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EFFECT OF FORESTS ON RUN-OFF

BY J. C. STEVENS.

(This article is the first of a series in which the effect of forests on run-off is thoroughly discussed. The author leads up to the conclusion that they do not exercise any appreciable influence upon stream flow and that where it does exist in slight degree it may in some cases be beneficial, and in others harmful. Mr. Stevens is a civil and consulting engineer, Portland, Oregon, and Apartado 491, Barcelona, Spain; a member of the Oregon Society of Engineers, and formerly District Engineer, U. S. Geological Survey, Portland, Oregon.—The Editors.)

The theory that forests on the watershed of a stream act as a substantial conserver of precipitation has been accepted by the great mass of people as an established fact. It is a plausible theory and has been so oft-repeated that those who have given the subject only casual thought or superficial study accept it without further question.

The truth of the matter is, however, that this theory is neither established nor admitted by many whose opinions on the subject we are obliged to respect. There is no evidence in the world today that will either absolutely establish or absolutely refute the theory. Because of this fact it is necessary, in order to reach a rational conclusion on the subject, to resort to inductive reasoning and then to draw whatever conclusions are warranted by such data as we have.

I shall first treat the subject of precipitation,



Water Conservation Above the Timber Line.

run-off, erosion, etc., and the relation of forests thereto in a general way. Next I shall present whatever data I have been able to gather on the subject.

Relation of Run-Off to Precipitation.

When water is precipitated in the form of rain, a portion of it runs from the surface directly into the water-courses of the region, and a second portion percolates into the soil and underlying rocks and appears lower down in the stream channels in the form of springs or seepage water. Those two portions together constitute the run-off from the water-shed. A third portion sinks too deep into the ground to



A Gradual Run-Off From the Melting Snows.

appear as run-off. A fourth portion is evaporated directly from the water surfaces, moist soil and wet vegetation on the area. A fifth portion is transpired by plant growth, i. e. given off as vapor from plant leaves and used in the body of the plant itself. A sixth portion remains stored in lakes or in the interstices of the soil and rocks comprising the area. If precipitated in the form of snow, the water is not disposed of in accordance with these several processes until melting occurs.

The water that falls on an area disappears by any or all of the six routes about outlined, and the proportion that disappears in each depends upon the conductivity of each route, so to speak.

The amount of run-off depends upon the following principal factors:

1. The porosity of soil and underlying strata. On this largely depends the division of water between surface flow and shallow percolation.

2. The intensity and nature of precipitation. Gentle showers for several days may produce very little run-off, while half the amount falling in a few hours would produce a flood. A snow fall, of course, produces no run-off until melting occurs; then the water disposes itself in virtually the same manner as if newly precipitated.

3. The condition of the ground prior to precipitation. If frozen or saturated, no infiltration is possible. A snowfall on frozen ground will all appear as run-off when it melts. If the ground was unfrozen, considerable water may percolate into it at the time of melting. Completely saturated ground acts in a similar manner with rainfall.

4. The topography of the area. Steep slopes permit rapid surface flow, while gentle slopes permit greater percolation other factors being equal.

5. Cultivation. This affects the porosity of the surface soil. Fallow fields are very receptive to percolation.

6. Vegetation. The roots and stems of grasses, brush, trees, etc., mechanically retard, to some extent, the flow of surface water and permit percolation. The principal effect of vegetation, however, is through the medium of evaporation and transpiration.

7. Evaporation and transpiration. The greater the evaporation the less the run-off, other things being equal. The greater the area of lake surface on a water-shed, the greater the amount of evaporation. Trees and plants evaporate enormous quantities of water as long as they are wet, and continue to transpire large quantities of water long after evaporation has virtually ceased.

There are others, but these are the principal factors and they are so related one with another that the effect of one cannot be isolated except under identical conditions regarding every other. The meagre data with which to solve problems in which these factors are involved, and the complexity of the problem, are at once apparent. The relation between precipitation and run-off has engaged the attention of engineers for years, yet up to the present time no satisfactory relation has been established between them. All that we can expect to show are general tendencies produced by certain factors. It is impossible to account for all the factors that enter into the problem. No two drainage areas are alike, hence each area is a law unto itself in this respect.

In arriving at any rational conclusions as to the effect of forests considered apart from all the other factors, no hard and fast rules can be laid down. The evidence gathered from experimental data and observation is so conflicting that only the more general conclusions can be utilized. Each region must be considered on its own merits, in the light of general knowledge adapted to its own peculiar conditions.

Many beneficial effects of forests are claimed that do not exist at all, and other claims are too intangible to admit of serious consideration. The following claims taken mainly from Bulletin No. 7, Department of Agriculture, Forestry Division, "Forest Influences," may be dismissed with the mere statement of them and the remark that if they exist at all they are not of sufficient magnitude to be of economic importance:

(a) Extremes of temperature of air as well as of soil are prevented.

(b) The average humidity of the air is increased.

(c) The disposition of precipitation throughout the year is favorably affected.

(d) By condensing dew, hoar-frost and ice on their branches, trees add to the precipitation.

(e) Forests keep the soil underneath granular and porous for the reception of water.

(f) Oxygen and ozone production by forests increase the purity of the air.

(g) Soil conditions of the forests are unfavorable to the production and existence of pathogenic microbes.

The claims that will seriously engage attention may be briefly summarized as follows:

1. Forests induce greater uniformity of stream flow than would obtain without them.
2. Forests prevent soil erosion.
3. Forests increase precipitation.

The small actual effects of these factors will next be discussed.

The agencies by which forests are said to increase the uniformity of stream flow are:

1. The bed of humus that develops under a forest cover retains a portion of the water that falls during wet periods and delivers it to the streams through the underlying soil in dry periods. Floods are diminished and low stages augumented by the amount of water thus retained.

2. Forest litter, roots, etc., mechanically retard the flow of water over the land surface and discourage the rapid rush of water into the streams. Soil erosion is thus prevented and flood heights diminished.

3. Forest shade retards the melting of snow in the spring and thus the period of run-off is prolonged.

Each of these generally accredited properties of forests will be considered first in general terms, then with such actual data as I have been able to gather on the subjects.

[To be continued.]

LIGHTING CRISTOBAL DOCKS.

An extensive system of lighting is being installed in the new docks at Cristobal. It provides for a total of three hundred and fifty 250-watt units inside and outside of the superstructure. These lights will be arranged in nine rows, spaced 30 ft. apart, seven rows extending the length of the dock structures on the inside, and one row along each side of the docks outside, and also across the ends. In addition, there will be a fixture on the outside corners of both buildings, consisting of a concrete bracket and reflector, similar to those employed in lighting the Canal locks. Each of the outside lights will be provided with a cast iron protector hood painted with two coats of lead paint and sanded, giving them the appearance of having been made out of concrete. It is estimated that about 26 miles of wire will be required for the electrical installation at both docks.

All the main cables are No. 4 insulated, lead-covered, and extend from the under-ground cable duct line in Cristobal to transformers in manholes near the docks. From the transformers, the cables are drawn into the buildings under the floors of the docks, terminating in a main panel situated in one corner of each dock structure. This panel is of slate, contains the usual switches and other operating apparatus. From this main panel, individual varnished cambric, lead-covered, No. 2, 3-conductor cables lead to eight smaller distributing panels in each dock structure, situated in the side walls, four to each side, spaced at about equal distances apart. These eight cables are carried in 2-inch galvanized iron ducts embedded in the roof concrete. From these points, the lights, in groups of four each, are supplied with current carried by No. 12 rubber-covered duplex wire enclosed in ½-inch galvanized iron conduit, embedded in the roof concrete. The units are composed of type S E E 250 reflectors, with 250-watt tungsten lamps.

THE RAILROAD COMMISSION AND THE PUBLIC.

BY JOHN S. EASTWOOD.

(The author reviews the public utility rate-making situation and affirms that the Railroad Commission of the State of California should fix the rates of all public utilities in the State of California, including those operating in municipalities.—The Editors.)

The railroad commission of the state of California should fix all the rates of all the public service companies in the state of California. It should be given full power to act as a court of arbitration between the public service companies and the public. It should be given the opportunity to assist the public service companies as well as to limit them, thereby benefitting the public as well, and it should perform the function of fixing the rates, for by so doing they can assist the public service companies by giving them the necessary financial stability, impossible under the present methods.

By having complete control of all the rate fixing as well as the regulating power it will be possible for the railroad commission to protect the public service companies from the public and the public from the public service companies. Each needs protection from the other. The stabilizing of the public service companies will benefit the public.

That each one of the above statements is true needs no demonstration.

The growth of public service is recent, has been rapid and is ever expanding and including new functions, and to its rapid growth can be laid most of the faults, real or imaginary, ascribed to public service companies by the public.

A hostility has grown up between the public service companies and the public due to their peculiar relationship, but mainly because of the more or less monopolistic character of the service, also because of the ability of the public service company to deprive the consumer of the service upon non-payment of bills.

Most people believe and insist that they are honest, and that they are sincere in this belief cannot be gainsaid, but too often they are influenced in their standard of honesty by their personal feelings, which are not a safe guide.

The account of the butcher, the baker and the candle-stick maker can be stood off, and they have no recourse when beaten out of their accounts, for many others are doing business in the same lines, but the public service company's service is one that can not be had elsewhere, conveniently, and this is the galling fact.

This condition compels a payment for a service that has been rendered at the date of presentation of the account. Too many people look upon this condition as an infringement on their rights, many look upon it as impugning their honesty. People hate to be forced to pay a bill.

Look the matter squarely in the face and you will know that this is at the bottom of any grievance, real or imaginary, you have against the public service company.

We are all alike, we want what we want when we want it, and what we want is certainly not to pay for a common place service that has been rendered, if we can help it, but to spend our money for joy.

We prefer to spend our money for the joys of life, not for the dead horse bills for necessities.

Our joys may be fine raiment, the bright lights, the music, the tinkle of glasses with a silver bucket on the side, or it may be gasoline and high speed with a highball now and then, or again it may even be sweet charity, or white ribbons and tea, but what ever our joys are, they are the things we delight to spend our money for.

It is often said that in this world there is nothing certain but death and taxes.

All people hate a tax. A tax must be paid or property will be taken for its satisfaction.

A public service is not a tax, but the conditions of our modern life make it come very near it.

Property can not be taken for the non-payment, the consumer has had the service, and is obliged to get along without it for what he has had unless he pays the public service company has an unpaid account, and both have a grouch.

It is therefore hopeless to think of an entire removal of hostility.

Some people think the only cure is public ownership.

Public ownership will shift the position of the difficulty, and possibly the distribution of the burden of payment but does not remove the difficulty.

The same conditions as to payment of bills must remain.

It is the last stage, and there is no recourse.

People who cry for it will then have not only to pay, but pay more for less efficient service.

None of the utopian dreams or rosy ideas work out in practice, principally because all incentive to good and economical service is removed as soon as it is in the hands of the municipal employes.

What is everybody's business is nobody's business.

There is no way to compel efficient municipal public service.

The functions are so many and needs of the municipalities so great, in addition to that of public service, that there is not, and can not be, property value enough in the municipalities to permit bonding them to acquire all the public service required by modern conditions.

That being the case there is no other way, than to have privately owned public service companies, for this service has become a necessity.

If they must remain in private ownership, they must furnish service to the public on a reasonable basis.

A reasonable basis is that there should be a fair return to the owners of the public service company for the service.

But the determination of what is a fair return is one of the biggest problems now before the public service commissions, whose duty it is to do the rate fixing.

It is a problem that is intricate and variable, and can only be solved by those having the facilities to determine, and integrate all the factors that enter into it.

The rate fixing should be in the hands of the state railroad commission, for it alone is in a position to get the necessary data upon which to arrive at a fair basis for rate fixing.

The rate fixing should be in the hands of the state railroad commission, for it alone has the service of experts to solve the problem of the fair basis of the rate fixing.

The rate fixing should be in the hands of the state railroad commission because it alone is capable of doing so in strict justice as between the public service companies and the public.

The railroad commission should not be hampered in the performance of this enormous task by being compelled to hire any but the very highest grade expert talent, for such service to the public is cheap at any price.

The last person in the world that should have the rate fixing power is the councilman of a municipal corporation, because he is in every way unfitted and disqualified for this work.

He can not do it in fairness to himself, the public or the public service company.

He has not the knowledge, the time, or the ability to acquire the knowledge to enable him to take up the matter of the solution of the problem of the fair rate fixing basis.

He is under political obligations to the voters of his ward, and there is a definite, or implied promise on his part to reduce rates in return for his election.

He is himself a consumer of public service and has his own natural inclinations to resist, when he is a fair-minded person.

When he is not a fair and honorable citizen, and such cases have been known, it is impossible to tell where he will stand.

There can be no more unfair condition imagined than to expect a fair adjustment of public service rates from a man who has absolutely no element in his relationship to the public service company, other than that to lead him to cut the rates down.

The question always is, "how much are the rates to be cut down?" And not "how are the rates to be adjusted?"

The councilman is handicapped by public suspicion of graft if he is fair to the public service company, or is blamed by the citizens for not doing his duty to his constituents who elected him, if he does not cut the rates down.

The rates for public service have been thus forced down in price at about the same rate that other necessities of life have gone up.

A decrease in rates can not continue indefinitely, for sooner or later it will reach the zero point.

During the period in which the public service has been developed, it has been steadily forced down in price, while labor and the cost of living and most all materials have steadily gone up.

It stands to reason that with two things moving in the opposite directions, the one down the other up, the apparent speed of their departure from each other is rapid, and it takes but a short time for them to reach the extremes of separation.

The public service companies have been bled till they are anaemic.

They have been starved till they are unable to

make the necessary improvement, except at ruinous financial sacrifices, which weaken them still further.

They have been cut to the quick until the very nerve centers are laid bare.

They are in the condition of the farmer's horse that was being trained to live on a straw less every day—their bones are emerging.

The public service has become the big end of business, and it stands to reason if the big end of the business is sick, the remainder of the business body can not long remain well.

That is what is increasing the army of unemployed.

Samson destroyed himself as well as his enemies when he pulled down the pillars of the temple.

The public service companies are suffering from a lack of confidence on the part of the investing public in their safety and stability.

It is an often heard complaint that they are over capitalized and that stock is watered.

This is partly true in some cases, but is largely due to laws made to harrass rather than to help corporations.

All the pioneers in public service know to their sorrow that when a demand had first to be created for the service, all the so-called securities were liquid, and a buyer of bonds was not an investor, but a bold speculator.

If the tide took him in, he was successful, if it took him out he was a wreck.

Corporations were and are obliged to lay a large foundation to meet the conditions of growth, and are obliged to make their provisions in the start of the business for future growth, due to the cumbersome corporation laws, that make enlargement so difficult.

There has been forced on them the combination of small corporations, that were organized to meet the small demands for service in the beginning, and these companies must be kept alive and fully organized until the last of their obligations have been met.

Thus the holding company, interlocking directorates and affiliated companies, under the corporation laws, become a necessity.

It has been made more and more onerous and difficult to incorporate companies and to transact corporate business, the idea being to harrass and discourage rather than aid corporate investment.

All of these things have made it more difficult to finance these concerns, necessitating stock bonuses, but none of the obstacles of law are so potent as the fear on the part of the investing public that they will be ground to powder between the upper and the nether millstones of commission regulation and municipal rate fixing.

This condition of financial instability may not seem to be of much interest to the consumer of public service, but in the end the consumer will pay for the ruinous sacrifices the public service company has had to make in order to deliver the service.

With the settled condition that would be brought about by the complete regulation of policies and income by a just tribunal, the finances of the companies should be so vastly improved that it would be possible to sell their securities at or near par in the open market, for they would then be sought as a safe investment, rather than as a speculation, the contract for works could be let to the lowest responsible bidder, and the company and the public through it would have the full value of the economy in cost in the reduced cost of the service.

The condition of the public service company may be justly compared with that of a snake trying to crawl through a hole under a high wall, the public service commission punching it on the tail to speed it up, the public on the other side beating its head off.

To give good service, the public service company must be properly sustained, it can not be expected to furnish the best service at the best economy under the strain of fear of annihilation of the values of its securities.

And under the present conditions this fear is ever present for there are so many people that would like to use the machinery of municipal competition to wreck the privately owned public service company.

This effort is now being made in the two largest municipalities in the state and many of the best citizens have their sense of honor so eclipsed by petty spite, that they think it a square deal.

This desire on the part of the people to get the public service in some lines into the ownership of the municipality is due on the part of many who know they will have to pay more for poorer service, to their antipathy to the public service company.

It is due on the part of many more, who honestly believe on account of representations made to them that there will be a lower rate and better service, even though they know the investment and operating expense will be higher.

It is a hope that some way, some one else will have to carry their burdens.

All the experiments thus far made with the municipal ownership have proven that municipal public service costs more to somebody than privately owned public service.

The reason that in some cases it appears to be cheaper is because of the method of distribution of costs by the bookkeeping methods employed. The burden is not so fairly distributed, as the tax deficit must be borne by the property owner, who may not even be a consumer of public service.

Competition in public service between a municipal and a privately owned public service company is unfair and expensive, both to the public service company and the municipality.

It should be made possible by a law giving such power to the railroad commission as to prevent competition between a municipality and a privately owned public service company.

At least such municipal public service as is in competition with privately owned public service in the same line should be regulated by the railroad commission.

Another phase of the situation to which the above leads, and that is that competition between regulated privately owned public service companies is not only unnecessary, but is wasteful.

Though the Federal government, through the Sherman law, is trying to create a condition of artificial competition by the trust busting methods, its acts so far have not been shown in any increase of

efficiency or decrease in cost of the products of the busted trusts.

It would be far wiser were a law enacted by the congress to begin at the seat of the trouble and regulate the trusts as to their financial stability and the price of their products to the public, and thereby make the present big business securities a safe investment for the many, rather than to try to scatter the evil, only to add to the cost of their administration and reduce their ultimate efficiency.

The need of competition between the public service companies in the same market is entirely removed where the finances, the rates and the quality of service are all regulated by a public service commission.

It should be the policy of the public and of the public service commissions to encourage combination in the same natural field, for this all tends towards, and leads to, a reduction of the cost of the public service, both by the reduction of the overhead costs, and also by the removal of unnecessary duplication of plant.

Competition and duplication in telephone service particularly is not only utter folly under regulation, it is a crime against the common people. The removal of competition should also add to the element of financial security and lead to the economy of extension of service, that can be had only with financial stability.

A sane state regulation removes any excuse for the foolish, impractical and drastic regulations imposed on the development of water power in the forest reserves by the officials of the Federal government.

The people of the states where the public utilities are commission regulated are only hampered by these Federal regulations, and the Federal regulations of water power development should be discontinued in all such states.

These regulations are intended to cover the same jurisdiction as that of the public service commission, but they are unsettling of the financial standing, owing to the revoking clause, and are based on the federal policy of preventing combination, which is also bad.

The people of the state should not be obliged to pay the Federal government for the use of its own water, for this is what the forest service charges amount to.

No water power is worth anything to anyone not connected with an existing power company, for the reason that it is the policy of the railroad commission to prevent competition except as a matter of public convenience and necessity.

This policy is not only right as tending to stabilize the existing companies, but it is to the interest of the public as well.

There will be no new water power development in California for general distribution, except by some one or other of the existing companies, and there should not be.

As time goes on, more and more of the necessities and comforts of life that are subject to general distribution will come under the head of public service, for there is a constant accretion of inventions that at first are luxuries and finally become by use necessities, and their general distribution make them public service.

The rates as well as the finances of the public service companies should be regulated by the railroad commission, because it is the only fair tribunal capable of coming to a just decision as to the relations of the public service companies to the public and the public to the public service companies; because it is the only way that confidence can be restored in the public service securities, and stability given to the investment; because this stability inures to the benefit of the consumer who will thereby receive the maximum of service at the minimum cost; and because the public needs protection from the exactions of the public service companies, and the public service companies need to be protected from the avarice of the public.

CENSUS FIGURES ON ELECTRIC LIGHT AND POWER.

Preliminary figures of the forthcoming quinquennial report on the central electric light and power stations of the state of Idaho have been given out by Director W. J. Harris of the Bureau of Census, Department of Commerce. The figures presented for Idaho show that during the decade 1902-1912 there were substantial gains in the industry. The number of establishments increased from 19 to 38, of which 35 were commercial and 3 municipal; the increase in income was 725.9 per cent, from $192,206 to $1,587,407, and the increase in expenses was 989 per cent, from $141,160 to $1,537,260. The number of persons employed in the industry was 324 in 1912 as compared with 88 in 1902. There was an increase in the total horsepower employed from 5454 in 1902 to 56,375 in 1912, of which 4525 horsepower was generated by 14 steam and gas engines (including turbines) and 51,850 horsepower by 63 water wheels. The kilowatt-hour output of stations increased from 5,018,149 in 1902 to 115,812,292 in 1912.

The arc-light service was 557 in 1902, compared with 1,349 in 1912, an increase of 142.2 per cent, while the increase of "all other varieties" of lighting service was 685 per cent, from 33,262 lights in 1902 to 261,096 in 1912. The number of stationary motors served increased from 163 in 1902, with a horsepower capacity of 205, to 1773 in 1912, of 27,142 horsepower.

Idaho.

	1912.	1907.	1902.	Per cent of increase [1] 1902-1912..
Number of establishments	38	42	19	100.00
Commercial	35	40	18	94.4
Municipal	3	2	1	200.0
Income	$1,587,407	$719,395	$192,206	725.9
Light, heat & power	$1,551,549	$692,489	$191,126	711,8
All other sources	$35,858	$26,906	$1,080	.....
Total expenses, including salaries and wages	$1,537,260	$472,493	$141,160	989.0
Total number of persons employed	324	188	88	268.2
Total horsepower	56,375	13,694	5,454	933.6
Steam and gas engines (including turbines):				
Number	14	19	15	—6.7
Horsepower	4,525	2,202	1,530	195.8
Water wheels:				
Number	63	37	23	173.9
Horsepower	51,850	11,492	3,924	.....
Kilowatt capacity of dynamos	35,656	7,082	2,774	.....
Output of stations, kilowatt-hours	115,812,292	9,577,588	5,018,149	.....
Estimated number of lamps wired for service:				
Arc	1,349	[2] 966	557	142.2
All other varieties	261,096	[2] 122,491	33,262	685.0
Stationary motors served:				
Number	1,723	406	163	957.0
Horsepower capacity	27,142	4,054	205	.....

[1] A minus sign (—) denotes decrease.

[2] Exclusive of 11 arc and 1168 lamps of other varieties reported by the electric companies as used to light their own properties. Lamps used for such service were included in the number reported for 1912.

LIGHTING METHODS

METHOD IN HOME LIGHTING.

Introduction.

Home lighting improperly installed may prove a perpetual annoyance. Because overly brilliant it may unduly animate at those times when the opposite effect is desired; discomfiture results from its incompleteness; and high lighting bills are the monthly reminder of its inefficiency.

But by the use of proper methods, home lighting may be made artistic, harmonious and restful, and so contribute to home comfort and happiness. Effectiveness may be had with economy.



"Cheap Types Which Tire and Promote Ocular Discomfort."

Usually the purchaser of a small "ready-to-wear" house or bungalow is fortunate if the owner has deferred installing the lighting fixtures until chosen by the purchaser. He is unfortunate when a speculation builder with an eye to "how cheap," installs a lighting system at once unsightly, unsatisfactory and unsuited to the new home which, although otherwise pretty and complete, may in this way be marred. Familiarity with these cheap types which tire breeds disgust; they are usually unscientific also and cause ocular discomfort. The lighting fixtures add the finishing touch to the home and should be tasteful.

On the other hand, there is the artistic builder who realizes that it is unwise to "spoil the ship for a ha'porth of tar," and who therefore provides a complete lighting installation which harmonizes with the interior and the decorations. Such builders, and their number is increasing, do not set aside a small—a very small—percentage of the total cost of the building and say "thus far and no farther," but decide on the amount to be expended in this way only after careful consultation with a well-informed and well-intentioned fixture dealer. One who may be relied upon to confirm the choice only of those fixtures which will give satisfactory lighting results in addition to their artistic and harmonizing influence.

Method in home lighting goes still further back for it involves careful planning of the wiring system as well.

Builders who build to sell the house and not the purchaser, are careful to insist upon proper and complete planning of the wiring and switching arrangements as well as in the selection of fixtures. A proper lighting installation will often effect the sale. These builders recognizing the monetary value of method in home lighting look to their architects, sub-contractors or fixture dealers to provide that which will prove most satisfactory.

They who build their own homes should give this question considerable thought that a successful installation be assured. What follows covers this last situation, but is applicable, in degree, to the others also.

The Wiring Plan.

It is a good idea to mark the proposed outlets—those points at which switches, lighting fixtures, baseboard receptacles, telephones, etc., will later be installed—on the floor plan. It is much easier to alter locations on paper than it is to pay for "extras" for changing them after installation, and incidentally cheaper. Further it enables the wiring contractor to more carefully estimate the cost of the job, and if accompanied by a specification, ensures the installation exactly as you have provided.

To avoid confusion and to facilitate the work of contractors, symbols should be used for these markings which will be readily understood by those who have to interpret them, and the use of those which are standard is strongly urged.

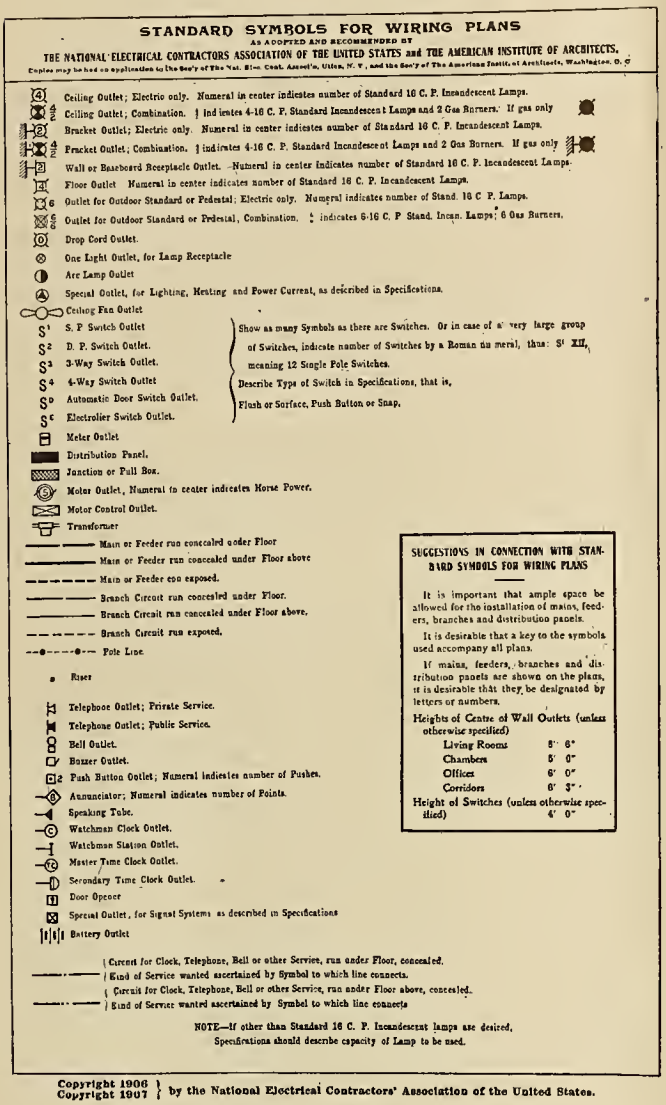
It is often advantageous to number the outlets for cross reference with the specifications.

Specifications.

It is the duty of the one who plans the installation to protect both parties from loss, and fundamentally a specification should therefore be to protect; to show what is desired done and to ensure its being accomplished at the pre-arranged contract price. It should form a part of the contract which should also invariably be made. This too, will tend to reduce "extras."

A word of warning against acceptance of the offer of those who say that they will do the job complete for a certain amount without a contract and thus save the preparation cost of plans and specifications. Their estimates are often remarkably low, and if you have commenced inquiries you will begin to wonder why it is that they can do it so cheaply. The reason is that they expect to trade on the customers inexperience. Their estimates are not inclu-

sive—there is always something you expect to get which they did not figure on supplying—and in this way they make their profit from "extras." The first estimate is usually lower, but the ultimate cost generally much higher than it would have been had the contract been made with a responsible firm—not to mention the difference in workmanship and quality of



STANDARD SYMBOLS FOR WIRING PLANS

AS ADOPTED AND RECOMMENDED BY

THE NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION OF THE UNITED STATES and THE AMERICAN INSTITUTE OF ARCHITECTS.

Copies may be had on application to the Sec'y of The Nat. Elec. Contr. Assn'n, Utica, N. Y., and the Sec'y of The American Instit. of Architects, Washington, D. C.

Ceiling Outlet; Electric only. Numeral in center indicates number of Standard 16 C. P. Incandescent Lamps.

Ceiling Outlet; Combination. ½ indicates 4-16 C. P. Standard Incandescent Lamps and 2 Gas Burners. If gas only

Bracket Outlet; Electric only. Numeral in center indicates number of Standard 16 C. P. Incandescent Lamps.

Bracket Outlet; Combination. ½ indicates 4-16 C. P. Standard Incandescent Lamps and 2 Gas Burners. If gas only

Wall or Baseboard Receptacle Outlet. Numeral in center indicates number of Standard 16 C. P. Incandescent Lamps.

Floor Outlet. Numeral in center indicates number of Standard 16 C. P. Incandescent Lamps.

Outlet for Outdoor Standard or Pedestal; Electric only. Numeral indicates number of Stand. 16 C. P. Lamps.

Outlet for Outdoor Standard or Pedestal, Combination. ½ indicates 8-16 C. P. Stand. Incan. Lamps; 6 Gas Burners.

Drop Cord Outlet.

One Light Outlet, for Lamp Receptacle

Arc Lamp Outlet

Special Outlet, for Lighting, Heating and Power Current, as described in Specifications.

Ceiling Fan Outlet

S^1 S. P. Switch Outlet
S^2 D. P. Switch Outlet.
S^3 3-Way Switch Outlet.
S^4 4-Way Switch Outlet
S^D Automatic Door Switch Outlet.
S^E Electrolier Switch Outlet.

Show as many Symbols as there are Switches. Or in case of a very large group of Switches, indicate number of Switches by a Roman numeral, thus: S^1 XII, meaning 12 Single Pole Switches.

Describe Type of Switch in Specifications, that is, Flush or Surface, Push Button or Snap.

Meter Outlet

Distribution Panel.

Junction or Pull Box.

Motor Outlet. Numeral in center indicates Horse Power.

Motor Control Outlet.

Transformer

Main or Feeder run concealed under Floor

Main or Feeder run concealed under Floor above

Main or Feeder run exposed.

Branch Circuit run concealed under Floor.

Branch Circuit run concealed under Floor above.

Branch Circuit run exposed.

Pole Line.

Riser

Telephone Outlet; Private Service.

Telephone Outlet; Public Service.

Bell Outlet.

Buzzer Outlet.

Push Button Outlet; Numeral indicates number of Pushes.

Annunciator; Numeral indicates number of Points.

Speaking Tube.

Watchman Clock Outlet.

Watchman Station Outlet.

Master Time Clock Outlet.

Secondary Time Clock Outlet.

Door Opener

Special Outlet, for Signal Systems as described in Specifications

Battery Outlet

Circuit for Clock, Telephone, Bell or other Service, run under Floor, concealed. Kind of Service wanted ascertained by Symbol to which line connects.

Circuit for Clock, Telephone, Bell or other Service, run under Floor above, concealed. Kind of Service wanted ascertained by Symbol to which line connects

NOTE—If other than Standard 16 C. P. Incandescent lamps are desired, Specifications should describe capacity of Lamp to be used.

SUGGESTIONS IN CONNECTION WITH STANDARD SYMBOLS FOR WIRING PLANS

It is important that ample space be allowed for the installation of mains, feeders, branches and distribution panels.

It is desirable that a key to the symbols used accompany all plans.

If mains, feeders, branches and distribution panels are shown on the plans, it is desirable that they be designated by letters or numbers.

Heights of Centre of Wall Outlets (unless otherwise specified)

Living Rooms	8' 6"
Chambers	8' 0"
Offices	8' 0"
Corridors	8' 3"

Height of Switches (unless otherwise specified) 4' 0"

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"Symbols Which Will Be Readily Understood."

materials. This of course does not apply to those cases where the fixtures only have to be installed and the customer visits a fixture dealer to make the selection.

Fire Hazard.

Workmanship and quality of materials are of great importance in connection with electric light installations not only because it is desirable that the completed installation please the eye, and be more or less permanent, but it must also be so installed that the "fire hazard" is reduced to a minimum. This fire hazard is mythical when the installation is made according to "Code," but the cheap job is usually skimped in the hope that a careless inspector will permit the poor workmanship and material to pass. It is therefore advisable to require a Fire Underwriters' certificate of inspection in addition to that of the municipal electrical department certificate.

The National Electric Code.

The "Code" referred to is a very complete set of rules issued by the Board of Fire Underwriters and is the outcome and growth of years of experience in providing rules which properly followed will result in maximum safety—reduction of the fire risk to a minimum. These rules are recognized throughout the nation.

It is therefore usual to include in the specifications a provision to the effect that all work must be done in accordance with these rules. This, however, will be taken up in more detail later.

Limitations.

Although this subject has so far been discussed in a general manner, and in regard to matters applicable to all installations it is nevertheless impossible to do this as we get down to cases.

It is the intention to eventually conclude this article with the light and illumination plans and specifications of a small home, but before doing this it is advisable to still devote some space to the manner in which each room and the exterior house and and grounds of homes in general, might be equipped. This will be taken up in the following order:

(1) The Entrance Gate, etc.
(2) Outside Decorative Lighting.
(3) Veranda and Porch.
(4) Entrance Hall.
(5) Living Room.
(6) Dining Room.
(7) Den.
(8) Kitchen, Pantry and Cellar.
(9) Bedrooms, Bathroom and Boudoir.
(10) Servants' Bedroom.

There is also the much mooted question of direct, semi-indirect, or indirect lighting. As there are differences of opinion as to what constitutes the "best" so in what follows it must be understood that individual views are presented. These are based, however, upon wide experience and with due regard to efficiency and effectiveness, and the limitations of each system both as regards economy and application, although each system represents good lighting practice under certain conditions.

[To be continued.]

LETTER TO THE EDITOR.

Cleveland, Ohio, January 8, 1914.

Gentlemen:—I have just noted in your January 3d issue the first appearance of your new department on "Lighting Methods." I feel that you are to be congratulated on this new departure as there is unquestionably a distinct field of usefulness for your magazine in illumination and lighting matters generally on the coast.

I trust that much new and valuable material will appear in your successive issues and shall look forward to each number with interest.

Wishing you every success in this new venture, I am,

Very truly yours,

E. B. ROWE,

Chief Illuminating Engineer, Holophane Works of General Electric Company.

HYDRAULICS.

BY OTTO B. GOLDMAN.

(In this installment of his series on Hydraulics the author presents a basis for rate-making upon the cost of service, which would result in more equitable rates and a more uniform loading of the power plant. The author invites discussion and criticism of his views.—The Editors.)

VI—Power Rates.

For power rates to be equitable, they must be based upon and directly proportioned to the cost of rendering the required service, and this ratio of rate to cost of service must be a constant for all classes of service. The service to be rendered by a power company to its customers varies greatly, not only with the class of service but with the time of the day and year.

At the present time Public Service Commissions are expending a great deal of energy and time upon obtaining an equitable rate for power and light service furnished to the general public.

The National Electric Light Association has employed men to make extensive and theoretical analysis in order to substantiate the rates promulgated by the Public Utility Corporations themselves, who are members of that association.

Articles such as "The Graphic Representation of Electrical Rates," by H. E. Eisenmenger, published in the "Journal of Electricity, Power and Gas," July 20, 1912, is a specific attempt at a theoretical exposition of a rate.

Feeling that past endeavors have only resulted in specific application of theoretical treatises on this subject and that these were based upon arbitrary assumption, not in accordance with the physical conditions involved, the following article has been submitted.

In practical application the past endeavors seem to lead to establishing rates which force the small customer to bear the heaviest burden.

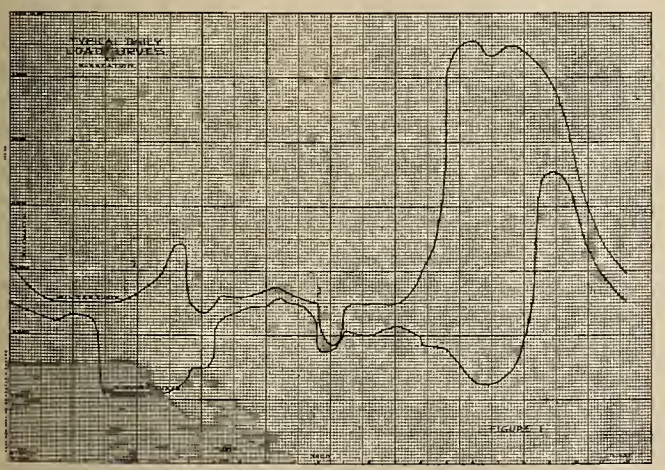


Fig. 1.

It is not a far cry and we are rapidly approaching the date when it will be necessary for our Public Utility Commissions to establish a theoretical, practical, universal and equitable method on which to base all lighting and power rates, and not accept and endorse public utility corporations' own self-devised and defensive systems of obtaining these rates as submitted to them. The same may be said of rates for gas.

Fig. 1 represents a typical 24-hour load curve, taken at the substation, and therefore representing the aggregate of all classes of service on the line. The upper curve was taken in the winter, and the lower in the summer.

Fig. 2 illustrates the difference in service required by different classes of customers. A and B are strictly lighting loads, of residences and apartments, having two pronounced peaks, a minor one in the morning between 7 and 9 a. m., and a major one between 5 and 11 p. m., with practically no intermediate load. The business load shows a good day load with a very heavy peak load coming on rather earlier than the residence peak, while the mill and factory load is essentially a day load, falling off well before the heavy evening peak lighting load.

The size of plant required by loads A, B and C would be about 250 amp., while that for all four would be only 316 amp.

To make matters more intricate we have the seasonal load variations, as shown in Fig. 3. This is based on kilowatt-hours consumed per month. It shows that, from April to and including August our kw.-hr. consumption is comparatively low.

At present but little is done toward giving the individual consumer a rate based upon the cost of rendering the particular class of service he demands. The rates are essentially alike for all classes of service. For example, he is assessed the same maximum demand charge whether his load comes on during the day when our load is light or on our peak load. The rates at present are based upon a maximum demand charge plus a rate per kilowatt-hours plus a constant, or on a "sliding scale" as illustrated in Fig. 4, used by the city of Seattle. In the first place decreasing the rate with increased size of unit other conditions being equal, is analogous to giving a better rate to a man shipping a thousand carloads of freight per year than to one shipping but ten. Such a practice is entirely indefensible if the power company is viewed as a public agency as laid out by Commissioner Thelen of California.

In taking up the matter of maximum demand charge, we will again refer to Fig. 1. Except between 4:30 and 11 p. m., this shows a maximum winter load of 3400 kw. Were it not for the period above referred to, this size of equipment would be ample. But for that period we need a 6600 kw. plant. Similarly during the summer, between 8 and 12 p. m. we need a 4600 kw. plant and for the remainder of the day a 2600 kw. plant would do.

Taking up the matter of fixed charges, in view of the foregoing it would be eminently unfair to assess this class of charges against the customers during any one moment except in proportion to the size of plant required by the aggregate of customers during this unit of time. We may therefore lay it down as a general rule, that the fixed charge component of the rate per kilowatt per hour during any one hour of the 24, is the fixed charge corresponding to a plant of the size required during that hour, divided by the number of hours during the year in this hour that the plant is used, and divided by the total kilowatts during this hour, per power component. Thus if p_0 kw. are coming on during an hour when the substation load is used continuously during the year, p_1 kw. are used

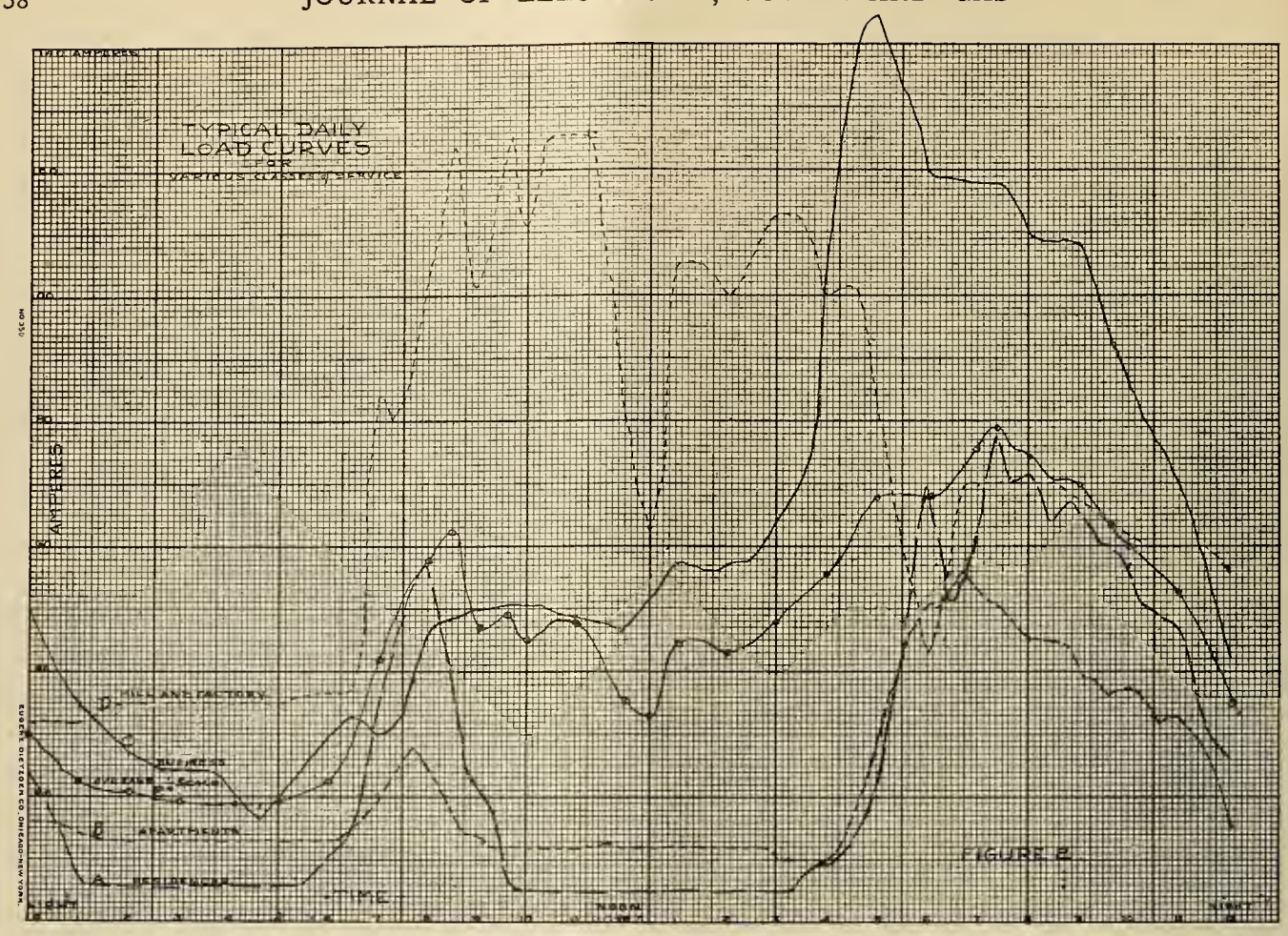


Fig. 2.

n_1 hours per year, p_2 are used n_2 hours per year, etc., and if s_0, s_1, s_2, etc., are the corresponding fixed charges, then if a customer has a load of k kilowatts the fixed charge component of his rate would be

$$R^r = \left(\frac{S_0}{365 \times 24 \times p_0} + \frac{S_1}{n_1 p_1} + \frac{S_2}{n_2 p_2} + \frac{S_m}{n_m p_m}\right) k P_m$$

kw. where $P_m = p_0 + p_1 + p_2 + \ldots\ldots\ldots + p_m$.

The part in the parenthesis is our fixed charge component of the rate per kw. during that hour. In present rates this component of the rate is simply

$$R^{r1} = E\left(\frac{S}{365 \times 24 \times P}\right)$$ per kw. of maximum demand

when P is the aggregate maximum demand during the year, and S the corresponding fixed charge. E is the "sliding scale" factor by which the heaviest burden is placed on the small users.

It is evident from the above, that the present rates, where otherwise justifiable in the aggregate, makes the lighting rate considered as a whole too low, while the power rate is too high. So also is the summer rate, as a rule, too high as compared with winter rates. As compared with that, the fixed component of the rate as we have laid out above, is simply the actual cost per kw. with allowable interest on the investment, during any unit of time, and therefore takes into consideration the class of service the power company is called upon to serve. It will encourage better loading of the power plant as much as physically possible, because it will be to the customers' interest to do so.

You will note that we find no need for the pretty but misleading term "load factor" as applied to individual customers. It is considered only in the aggregate or resultant effect of all customers at the substation or power plant. For example instead of giving a better rate to a customer operating 24 hours per day—load factor 100—he would get a better rate if he stayed off the peak load. This method of rating will also encourage the use of this power where it can only be used intermittently. A group of this class of users will average up about as well as the average plant. At present the rates are such for this class, as to be practically prohibitive. It is certainly not equitable to base the rates on the maximum demand shown during one hour or so during the month, as in this way the power company would be charging for service not rendered. This would be analogous to a labor organization saying to an employer that he will have to pay continuous wages on the basis of his maximum demand during, say, one day in the month or year on whatever theory they may wish to base this charge.

We thus see that the fixed charge is apportioned to the kilowatts consumed during any given hour, multiplied by the fixed charge component of the rate during that hour, or the fixed charge per kilowatt for any given hour is the fixed charge component of the rate. A similar analysis will give a similar result for the operating component of the rate. Be-

sides this each customer would have to pay a fixed charge per month for meter rent, transformer rent, if furnished, and the cost of meter reading, billing, etc., and also an initial fixed guaranteed repayment charge for any special material and labor furnished specially to connect up the individual customer and not commonly usable for other customers. This repayment charge could be made to extend over a greater or less

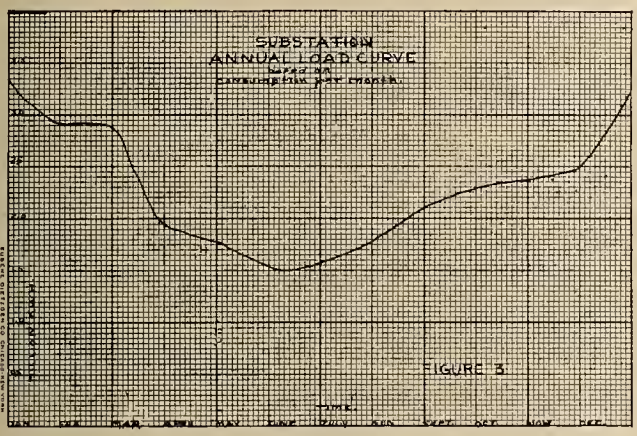


Fig. 3.

period to suit, but once completed, neither the customer nor the public generally should be chargeable with interest on this investment. It may be objected that the determination of the power used with reference to the time and the rating accordingly would be difficult and expensive. But after careful analysis of this subject, the writer came to the conclusion that a comparatively inexpensive meter could be devised to do both at once.

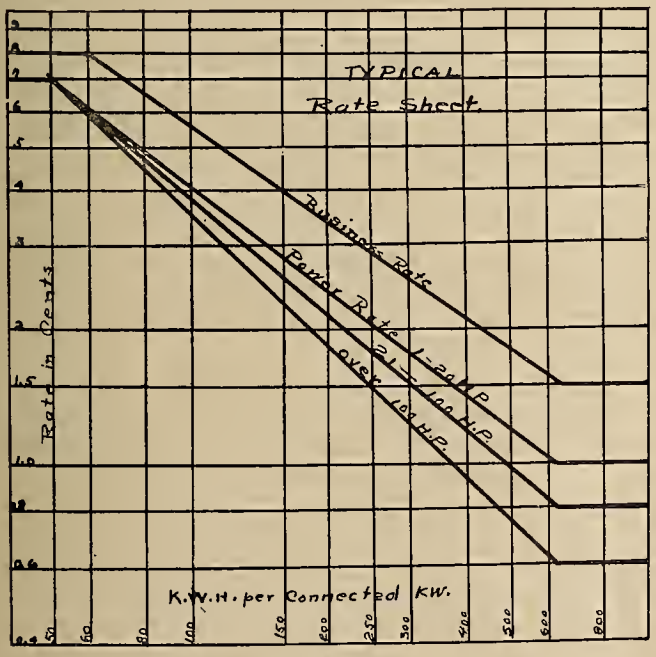


Fig. 4.

The power company is entitled to a fair profit on their investment, but are not entitled to charge for the power per se, as this is a public resource, unless the public, i.e., the government makes a charge on the power company, in which case they would be entitled to pass the charges on, to their customers. Again, as shown by Commissioner Thelen, the company is entitled to a return on a judicious investment only. The per cent of profit a company is entitled to should vary therefore, with the degree of skill and judgment shown in their investment and management. For example, referring to Figs. 1 and 3, if the generating plant consisted of a single unit, the average efficiency during the year would hardly exceed 40 per cent; if it consisted of two equal units, the efficiency would be about 55 per cent, while if this plant consisted of a 1200 kw., a 2600 kw. and a 2000 kw. unit, the efficiency would be made nearly 70 per cent with proper operation. Certain plant costs vary inversely with the obtainable efficiency, and therefore a good and skillful investment should be encouraged and entitled to better returns than a poorer one.

The above outlined system of rating is simply a method of properly apportioning the charges to the costs taking into consideration the different classes of service to be rendered. It would tend to load the power plant as nearly uniformly as physically possible. It will increase the power load, because of reduced rates during the day, especially during the summer, and by making the intermittent use of power possible. Especially now that the railroad and public utilities commission are taking up this subject, it is desirable that an equitable basis for power rating be found, instead of a temporary makeshift, so that these commissions will not one day find themselves in an untenable position.

The cracking of reinforced concrete due to electric current has resulted in numerous theories being advanced by way of explanation. That one which attributes it to oxidation of the iron anode has been fully established. The oxides formed occupy 2.2 times as great a volume as the original iron, and the pressure resulting from this increase in volume causes the concrete to crack open.

Partial electrification of the Rocky Mountain Division of the Chicago, Milwaukee & Puget Sound Railroad has been definitely decided by the management. The Deer Lodge-Three Forks section, to be first electrified, contains 113 miles of main line, or the equivalent of 168 miles of single track including sidings and yard tracks. Overhead trolley, suspended from mast arms on wooden poles, will be used on tangent track and span-wire construction on wooden poles over curves. This type of construction will be changed to steel poles and overhead bridge trolley construction in yards containing four tracks or more. It also has been definitely decided that the transmission voltage will be 100,000 volts a.c., feeding five substations ranging in capacity from 3000 kw. to 4500 kw., depending on their relative location to heavy grades. The operating current will be 2400 volt d.c. Essentially, the entire electrification, including the rolling stock, will conform to that installed by the Butte, Anaconda & Pacific Railroad. C. A. Goodnow, assistant to the president Chicago, Milwaukee & St. Paul Railway, authorizes the statement that no contract for the equipment has been let.

EVALUATION AND TRANSPORTATION SERVICE OF THE LOS ANGELES RAILWAY CORPORATION.

On the 23d of January, 1912, the City of Los Angeles passed "An Ordinance regulating the fixing of rates or compensation to be charged and collected by any person, firm or corporation for the conveyance of passengers for hire by means of street railway or interurban railway cars within the limits of the City of Los Angeles," and on July 1, 1912, the finance committee appropriated $15,000 for the purpose of making an inventory of street railways and an accounting of their records in order to determine what the rates should be. The inventory has now been completed and a condensed report of the findings of the Board of Public Utilities has been published.

It includes only the system and service of the Los Angeles Railway Corporation, no investigation having been undertaken of the Angels Flight Railroad, the Court Flight, or the Mt. Washington Railway.

The work was in general charge of consulting engineer, George A. Damon, Dean of Engineering, Throop College of Technology, and associated with Bion J. Arnold, of Chicago. A large part of the evaluation work has been carried on by the engineering staff of the Board of Public Utilities under the direction of C. K. Mohler, chief engineer of the railway department.

In one portion of his letter transmitting the report to the city council, president of the board, Augustine W. Wright states:

"Under the state law the amount of the bonded indebtedness must not exceed the par value of the capital stock for which subscription has actually been made, or conversely, the stock issue must be at least equal in amount to the bonds carried. There has already been issued $20,000,000 of Los Angeles Railway Corporation and $5,000,000 of City Railway stock certificates, which are not represented by a dollar's worth of actual physical property, and which are dependent on surplus earnings in order to create a market value. There is nothing criminal in the situation, as this procedure has always been recognized practice, not only allowable, but actually required by our state laws.

"Now, what should be done? We believe our first duty is to get control of the surplus. Any surplus earnings over and above a fair return should be available for more cars and better service; necessary extensions; renewals of equipment; the reduction of fares; or for depreciation as directed by the proper public officials.

"The 'extra profit' which is now thought to be 'fair' on account of the risk involved in the business should be reduced or entirely removed in the future by removing the hazard. It must be recognized that if the return upon the capital and upon the enterprise of the company is to be limited then the actual investment must be made secure.

"By taking all the chances ourselves, we can see no reason why the people should not be be able to turn the 'profit' which they now pay for 'hazard' and 'enterprise' into an amortization fund and thus provide for the purchase of the system out of earnings as one alternative, in case the city wishes to undertake municipal ownership.

"We have not undertaken to determine the relative merits or demerits of the municipality acquiring the property in this way, as compared to the issuing of revenue producing municipal bonds, or other possible means.

"The facts seem to justify the conclusion that in making such a contract the city could secure not only the right to purchase, but, by guaranteing the future of the system, could convert excess 'dividends' into a purchase fund and thereby secure the controlling equity."

The estimate of the "cost to reproduce" includes two important items—Real Estate for Car Houses, Substations and Shops, and Private Right of Way.

In accordance with Supreme Court decisions, the corporation was given the benefit of the appreciation in real estate values.

The report includes the following important statement made in this connection:

"It has been the practice, however, in evaluating railroad property for rate-making purposes, to give rights of way for railroad purposes a greater value than the adjoining land, and this practice has been approved by a number of commissions who have recognized various multiplying factors—some as high as three times the real estate value. Since the supreme court has decided that public utilities are to be given the benefit of the appreciated value of their land holdings in establishing their present worth, the problem of determining the value of terminal lands and rights in connection with railroad rate-making will become a very critical part of the rate question.

"In this particular case, if the fare is to be reduced, the railway company, no doubt, would claim that their perpetual rights to occupy the private rights of way have a strategic value a number of times larger than the values given and which we based upon the sales value of contiguous real estate, without using any multiplying factor."

The condensed report is summarized in the following recapitulation of fundamental facts:

1. Compared with other American cities, the local electric street car track mileage in Los Angeles is liberal for the area covered and the population served. As the districts reached by the local lines "build up" in density of population the income per mile of track may be more than doubled.

2. The system is just emerging from the "stage of development" onto a paying basis. Past earnings have not been sufficient to take care of a large allowance for depreciation and nothing for amortization.

3. Car service has been supplied on the policy that the riding habit can be cultivated by good service and the results have justified this policy. The rides per capita are very high—averaging nearly a ride per inhabitant per day—a record exceeded only by San Francisco, where the income per capita is $18.35, as compared with $16.20 in Los Angeles.

4. The present interest charges of 5 per cent on the original debt of $20,000,000 and 5 per cent on the actual cost of extensions financed through the City the original bonded debt of $20,000,000 and 5 per cent on the actual cost of extensions financed through the City Railway Company's account is "a reasonable return upon the present actual physical value" of the

system—but is not sufficient to compensate for "hazard" and "enterprise" in creating the property.

5. An annual "dividend" of 2 per cent on $20,000,000, or $400,000 yearly, is a reasonable reward for hazard and enterprise and should be allowed as long as present uncertain conditions continue.

6. An additional "dividend" of a larger amount than $400,000 annually is not justified by present net earnings. The payment of a dividend of $800,000 out of the current year's earnings was made possible only by anticipating net earnings—by using the depreciation reserve fund, or by borrowing money—any or all of which are dangerous practices.

7. Future "dividends" on account of returns over and above interest charges should depend in amount upon the extent of the hazard. If the risk to the investor is reduced, the rate of return should be correspondingly lowered.

8. The present five-cent fare, if continued during the coming year under present operating conditions and with a normal increase in earnings, will produce a surplus over and above the amount sufficient for interest charges and reasonable dividends. The control of this surplus should be in the hands of a public regulating body, which should decide upon the disposition of this part of the surplus net earnings for any or all of the following purposes: Better Service, Extensions, Renewals, Amortization, or Fare Reduction.

9. Considering the demands of the community for improved service and extensions, it is safe to conclude that a situation calling for a reduction of fares will not be reached in Los Angeles for a few years—but if the present rates of increase in population and passenger earnings are maintained a density of traffic can be anticipated in time which will justify a reduction from the present five-cent fare.

10. In anticipating future developments, it is safe to conclude that earnings will increase at a remarkable rate; that the percentage of earnings required for operating expenses should gradually decrease and that the ratio of investment to earnings should also be reduced—thus making the burden of fixed charges relatively lighter.

11. The local traction situation as compared to that in other cities is at present favorable to Los Angeles. The problem is to avoid the capitalization of the future possibilities.

12. The present management of the Los Angeles Railway Corporation is working under the following disadvantages:

(a) The franchise fabric is a patchwork.

(b) Many franchises expire before the bonds covering the investment are due in 1940. This $20,000,000 first mortgage bond issue, covering the greater portion of the property, is a closed mortgage and does not allow for the issue of any additional bonds to take care of improvements and betterments on the property covered by the mortgage.

(c) Extensions are made by a subsidiary company and the securities of this company are protected only by the piecemeal extensions and additional equipment, resulting in a limited market for these betterment bonds. Under present circumstances it is necessary for Mr. H. E. Huntington to buy these bonds personally.

(d) Constant growth requires money for improvements and extensions at a rate greater than the entire net earnings—so that if all the interest and dividend payments are reinvested, as has been the practice, it is still necessary to find about $500,000 a year new money in order to carry on the enterprise.

(e) During the next ten years the amount of money required for extensions and betterments will amount to fully as much as the present investment. To secure this capital it must be protected. The present franchise and financial arrangements do not afford the necessary protection.

(f) The sinking fund provision of the $20,000,000 bond issue will retire only about 40 per cent of the issue at the end of the 30 years' life of the bonds. Without any assurance that new franchises will be granted, the company is not in a position to continuously develop its property as a comprehensive system.

(g) No insurance fund is provided, nor is any amount set aside to provide a surplus for accidents, loss of business, panics or other contingencies.

(h) The recent political evolution which places powers of control of public utilities in the hands of the city and the state puts an entirely new aspect upon the development of the urban transportation business. If the public have the right to regulate rates, to control service, to order extensions both of lines and of the five-cent fare zones; to limit the return on the investment; to audit accounts, and to approve or disapprove the issue of securities, then there is lacking the incentive for the financier to build up the business with the expectation of extra large gains.

13. On the other hand, the city is working under disadvantages which can be briefly summed up as follows:

(a) There is no comprehensive franchise policy. The model franchises, the limitations of future grants to 21 years and the indeterminate provisions in recent permits reserving the right to purchase by the city, apply only to extensions and not to the entire system.

(b) There are numerous legal tangles in present franchise grants which may involve the city in tedious and expensive litigation before it can secure back again full control of its own streets.

(c) If the city endeavors to reduce fares at this time a controversy is inevitable, as the company claims it has eminent legal advice that their present franchises intrench them securely upon a five-cent fare basis.

(d) To attack the company with drastic regulation or franchise litigation will injure the credit of the company and the city. The unwise use by the city of these two clubs—regulation and litigation—will add to the hazard and expense rather than reduce them and must eventually increase rather than decrease the cost of city transportation.

The foregoing exposition of the actual weaknesses in the fortifications of each the company and the city, seems to show conclusively just one thing, viz:

Co-operation of the two, or "getting together" on a basis of the full rights of each party is the only way out.

Taking a broad view of the entire situation, the tendency of developments points to the advisability of the city and the company entering into a settlement agreement.

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Recognition of Western Rights

The Annual Report of Secretary of the Interior Franklin K. Lane is, in our opinion, the most enlightened and enlightening document which has ever come from the Department. The Secretary throws the light of his actual knowledge of local conditions into the dark corners of old controversies and makes a clear statement of policy as to the development of the national resources of the West. He recognizes the feeling that the former Federal policy has been unjust to the West in that while it closed opportunities to the monopolist it did not open them to the developer. He makes constructive suggestions for legislation that will enable active use of idle lands for the purposes to which they are best adapted. While the entire report as to conditions in Alaska, coal lands, petroleum, phosphate, potash, forests and reclamations are of great interest to the readers of these columns his remarks as to power sites are most significant:

There must surely be a rational way by which capital may be brought into this public service. The present condition of stagnation does no one good. Within a generation I believe the people will be as alive to the value of public ownership of hydroelectric power plants as they are today to municipally-owned water works. The people not being prepared, however, to put these lands to their highest use, **I am not in favor of keeping them from being utilized by private capital in the public interest.** Because we do not know what is best to be done is not a reason either for doing nothing or for getting rid of the trouble as soon as possible on the old "land-is-land policy."

When capital is given a fair and attractive interest with assurance of full return the public can be given good service and fair rates by regulating commissions. But when society takes the lion's share of the profit and yields no more to the operator than will make his work sufficiently attractive to keep him at it the impossibility of competition without waste is being attempted. In a new country where there must be large development and higher rewards for private enterprise some concessions might well be made.

What return shall the Federal Government have for its lands? My answer would be, no return whatsoever, provided the plant reverted to the government without cost at the end of 50 or 60 years, or so much of the plant as was based on the land itself and the improvements directly attached thereto, such as reservoirs, dams, water rights, and rights of way. For the tangible property of the plant, such as the distributing system and machinery, the government might well agree to pay an appraised price so as to insure its being maintained and extended during the later years of the life of the franchise.

Some may question whether the people of the United States will be ready for such governmental ownership within such a short time. Time is a necessary element in every evolution such as this and many believe that ninety-nine years would allow a less abrupt transition. Of course government ownership does not necessarily imply governmental operation. The experience of the Reclamation Service has already demonstrated that the operation and management of irrigation projects should be turned over to water-users' associations. Some other course may suggest itself later so that the needs of the users can be better accommodated than by governmental operation.

However, these suggestions are somewhat aside from the main issue. Such governmental endorsement could not help but be beneficial to the stability of power securities. The bond of a hydroelectric company would be as good as a government bond. And in return the government would be adding to its assets by having at its service the greatest brains of the nation in developing those resources that will eventually revert to the government.

Home Lighting

Architecture, decorations, furniture, atmosphere, safety, and the conservation of vision, each and all have some bearing upon the correctness of home lighting installations. Made properly and with due regard to all these, and economy is the remarkable result.

Today is a growth of yesterday and because this is so, the inertia of habit or custom, oftentimes difficult to overcome, is costly.

Yesterday the tallow dips, more economically made in quantities than at home, and secured with so much greater ease and cleanliness, were bought at the chandlery and hardware stores which, upon introduction of the oil lamps made of tin, sold these too, together with wicks and glass chimneys. Then came the more ornate lamps and the stores which sold the oil still held onto the sale of lamps.

Gas as a competitive illuminant, because of the method of its installation provided additional work for the plumber and even with the specializing of gas-fitting, the plumber-gas-fitter still holds his own.

The popularizing of electricity threatened to curtail a profitable part of his employment and in self-preservation, he hastened to adjust himself to this new condition by undertaking contracts for electrical installations.

As a transition period makeshift, this arrangement was excellent. But in order to keep abreast the times and so serve patrons satisfactorily, in the broadest sense of the word, specialization is essential. That plumber-electricians' have left a baneful influence upon home lighting is evidenced in the thousands of homes in which lighting installations improperly made are in urgent need of remodelling.

There were those too who sprung into existence to do this work exclusively but with the idea of "get the business anyway." They also cheapened this work, not because of any better method, but by the use of fixtures of indifferent and antiquated design, made cheaply and with a sincere disregard of the purposes for which lighting fixtures should be installed.

But home lighting is one of the refinements which not only calls for work well done and with the best of materials, but also for an exercise of artistic ability which recognizes the fitness of things—the interdependence of each instrument in rendering complete harmony.

With so wide a relationship between other aspects of interiors and the lighting it is small wonder that many specialists have sprung into existence with the idea of catering to this need. Fixture dealers with their specialties, and fixture and lighting studios are a natural and necessary consequence of a demand for the best in home lighting.

As opposed to the work of the plumber-electrician and his kind, their charges may appear excessive. But it is an appearance which is all on the surface, for underneath is the harmony, comfort, convenience, health, happiness and ultimate economy which is the invariable result of things well done.

In our department on Lighting Methods has been commenced in this issue a series of articles on home-lighting. These will aid in the giving of better service along this line and make for those improved standards the realization of which is the main object of this department.

Localization

The benefits of centralization of men and of capital have been great as compared to the results of the competitive conditions which it displaced. But every light has its shadow, every force its reaction, every good its evil. The great law of compensation is ever trying to establish an equilibrium which only the greater law of change can prevent. Some change now seems necessary to keep the advantages of centralization from being overwhelmed by its disadvantages.

Shade is grateful by contrast with the brilliant light of which it is the result; a force is supported by its resistance.

But with excess, correction is necessary. While the trouble may be stopped by shutting off the light or stopping the force, it is usually better to supply some neutralizing force to minimize the evils without destroying the benefits.

Because of the evils of city life it is not advisable that all men go back to the farm. But with more men on the farm there will be more work in the city. Such a solution of the problem of human centralization is suggestive of how to meet the difficulties of other kinds of centralization.

While eggs cannot be unscrambled as eggs, they can be assimilated by the body as albumen and fat. Dissolution of a compound need not produce the components from which it was originally formed. So when the great railroad systems were dissolved, the oil company dissociated and the tobacco trust broken they did not revert to the former condition of smaller companies competing from several centers for business in the same field. They formed new companies, each to serve its own territory and provide more intensive cultivation of the local market. Whereas these great aggregations were formed by a process of centralization, they have been re-formed by a method of localization.

Today far-seeing leaders are not waiting for a court decree but are voluntarily converting their organization into discrete units. The manufacturing end is being segregated from the sales end, and selling is being subdivided to meet the special requirements of each locality.

This process is pregnant with thought if applied to the special problems of every big organization. To decrease the overhead, augment instead of restrain trade, improve service to the consumer, and lessen vulnerability to overt attack—all this and more can be accomplished by following the dictates of the handwriting on the wall.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

Jno. Gilbert of Gilbert Bros., electrical contractors, San Jose, visited San Francisco during the past week.

Geo. L. Pierce, city electrician, Sacramento, was at San Francisco for several days during the past week.

H. Hayes, purchasing agent Mt. Whitney Power and Electric Company, was at San Francisco last week.

O. F. Swenson, salesman with Hunt, Mirk & Co., Inc., is making a business trip through Oregon and Washington.

H. S. Clark, Pacific Coast representative of Westinghouse Church-Kerr Company is on a business trip through Southern California.

Earl Fischer, commercial department Pacific Gas and Electric Company, has been called to Idaho on account of the illness of his father.

Richard E. Smith has been appointed California representative of the National X-Ray Reflector Company, with offices at 129 Sutter street.

A. T. Lloyd, local manager The Baker-Smith Company at San Francisco has left for an extended business trip throughout Southern California.

Geo. A. Boomer, Pacific Coast representative Plume & Atwood Manufacturing Company, is on a business trip throughout Southern California.

Thomas Mirk, president Hunt, Mirk & Co., Inc., San Francisco, expects to return to San Francisco from Seattle during the early part of the week.

J. B. Lukes, representing Stone & Webster Construction Company, San Francisco, left last Monday for the East and expects to be away for at least one month.

L. M. Cargo, district manager Westinghouse Electric and Manufacturing Company, with headquarters in Denver, is at Salt Lake City on his regular visit of inspection.

Sylvester Baker, Pacific Coast representative, Macbeth-Evans Glass Company, left San Francisco last week for a two months' trip through the southern part of his territory.

Chas. W. Wilson, erecting engineer The Westinghouse Machine Company, East Pittsburg, Pa., is at Honolulu erecting machinery supplied to the Hawaiian Electric Company.

W. G. Bryant, president, and E. J. Patton, general sales manager, of the Bryant Electric Company, located in Chicago, on a business trip to the Pacific Coast, arrived in San Francisco the latter part of the week.

Thomas M. Hurlburt and Harold A. Rando, civil and consulting engineers, have entered into a partnership and have opened offices at 502 Henry building, Portland. Mr. Hurlburt was formerly city engineer of Portland.

W. L. Goodwin, vice-president of the Pacific States Electric Company, announces the preparation of a paper on "What the Joint Committee of Contractors and Jobbers Stands For." It is contemplated to publish same at an early date.

Geo. P. Maddock has succeeded Harold Almert, resigned, as manager of the examinations and reports department of H. M. Byllesby & Co. Mr. Maddock has been the engineering representative of the company on the Pacific Coast for a number of years, residing at Berkeley, Cal.

Stanley Stevens, manager electrical department Fairbanks-Morse Company, Salt Lake City, left last Friday for Chicago and the East. While away he will visit the various factories of the Fairbanks-Morse Company and attend the annual salesmen's meetings at the company's general offices.

Merrill P. Robinson, illuminating engineer, formerly with the "Eye-Comfort" System in their Chicago office, is now connected with the Capital Electric Company, Salt Lake City, who will specialize on this system of lighting throughout the territory served by them, with Mr. Robinson in charge of this work.

Charles T. Leeds, formerly in charge of United States river and harbor work improvements in Southern California, and Wilfred K. Barnard, formerly engineer of maintenance of way and structures, Pacific Electric Railway Company, announce the formation of the firm partnership of Leeds & Barnard, and will engage in the general practice of engineering, with offices at 511-515 Central building, Los Angeles.

MEETING NOTICES.

Electrical Development and Jovian League, San Francisco.

The regular monthly business meeting of the League was held last Tuesday. Consideration of committee reports and routine business was the order of the day.

Oregon Society Engineers.

The Oregon Society of Engineers had its regular monthly meeting in Room "A" of the Central Library Bulding, at 8 o'clock, Thursday evening, January 8th, when Mr. Robert E. Edwards gave an illustrated lecture on "Concrete Roads."

Pacific Coast Electric Supply Jobbers' Convention.

The quarterly meeting which is scheduled for Del Monte will probably be held somewhere between the fifth and tenth of March and a large attendance is anticipated. Many eastern houses have signified their intention of sending out representatives to the gathering.

San Francisco Section, A. I. E. E.

The regular monthly meeting of the San Francisco section of the American Institute of Electrical Engineers will be held at Native Sons' Hall, 430 Mason street, at 8 p. m. January 23. Guy H. Bayley, chief electrical and mechanical engineer for the Panama-Pacific International Exposition, will present a paper and lantern slides on "Electrical Features of the Exposition," with particular reference to the distribution system. The public is invited. A dinner at the Hof-Brau will precede the meeting.

Pacific Northwest Society of Engineers.

This society held its twelfth annual meeting and dinner at the Arctic Club, Seattle, on Saturday evening, January 3, 1914, when the following officers were elected: Joseph Jacobs, president; Marvin Chase, Sterling B. Hill and Carl H. Reeves, vice-president; Jesse A. Jackson, secretary; Wendell N. Chase, treasurer; Climie E. Hill, librarian; J. D. Blackwell, Almon H. Fuller, D. W. McMorris, Milner Roberts, in-town directors; and J. J. Cryderman, Geo. A. Kyle, T. A. Noble and R. H. Thompson, out-of-town directors.

N. E. L. A. Transportation Committee.

At a meeting of the Transportation Committee of the National Electric Light Association at Philadelphia on January 8th, Chairman G. W. Elliott stated that a rate of 2c per mile had been quoted by the Grand Trunk Association in connection with the transportation of delegates to the Philadelphia convention. No special trains are to be run from New York or Boston. With regard to possible decision to hold the convention at San Francisco in 1915 it was the consensus of opinion that the trip should not be made as a tour, but that the committee would obtain further information and rates relative thereto, after which the matter would be again taken up by the committee for further discussion.

Jovian Electrical League of Southern California.

The regular weekly meeting of the Jovian Electrical League of Southern California was held Wednesday noon at Christopher's. Meyer Lissner delivered a very interesting address illustrated with stereopticon pictures, the subject being Camera "Flashes" during a "Short Circuit" of Europe. Max Loewenthal presided as chairman. A rejuvenation will be held February 6th. As a large number of applications have already been received a record class is expected.

The regular weekly luncheon of the Jovian League of Southern California was held at Christophers' on January 14,

J. O. Case being chairman of the day. Mr. Martin Betkouski spoke on "A Councilman—His Relations to the Public." Through the courtesy of the Garrick Theatre the members were also entertained by Professor Edward B. Warman, "human electricity." G. E. Arbogast will be chairman of the day on January 21st. A Jovian rejuvenation will be held on Friday, February 6th, at 6:15 p. m., at Union League Club. Out-of-town Jovians are particularly invited to attend.

Portland Sections A. I. E. E and N. E. L. A.

The January meeting was held on January 6th in the assembly rooms of the Hawthorne Building. Mr. B. S. Durkee's paper on "Duplex and Quadruplex Telegraphy" was a simple and forceful presentation of the subject and was enjoyed by the members in attendance.

Mr. A. S. Moody delivered a lecture with lantern slides on "Hydroelectric Developments on the Pacific Coast," which was well received.

The chairman called attention to the next Pacific Coast Convention in Spokane, September 9, 10 and 11, and urged every one to attend as he was sure it was going to be one of "the best ever."

The next joint meeting of the A. I. E. E and the N. E. L. A. will be a "social meeting," including dancing, on February 3d.

Efficiency Society Conference.

"What is meant by Efficiency" will be answered fully at the First National Efficiency Exposition and Conference to be held at the Grand Central Palace, April 4 to 11 (inclusive) 1914. Its aim and purpose will be to give expression to the increasing application of scientific methods to modern conditions. The plan and scope of the show will include displays of efficiency appliances, methods and products in Industrial, Mechanical, Governmental, Educational and Household fields; a series of mental and manual efficiency contests will be staged and conferences and illustrated lectures will be given. It will be held under the auspices of the Efficiency Society and in conjunction with the conferences of the society and other scientific organizations. The exhibits which will include displays by federal, state and municipal departments, public service corporations, office and household appliance manufacturers, vocational training schools and others.

Utah Electric Club.

The annual meeting of the Utah Electric Club held at the Commercial Club Thursday, January 8th, was given over to the election of officers and four new directors to succeed to the places of the directors whose terms expired on that date. The retiring directors were: C. B. Hawley, H. R. Bucks, W. W. Torrence, J. C. Jones. The newly elected directors are: W. W. Torrence, local manager General Electric Company; H. W. Kline, superintendent of plant, Mountain States Telephone & Telegraph Company; C. B. Hawley, president and general manager, Intermountain Electric Company; W. M. Scott, superintendent of electric lines and service, Utah Light & Railway Company.

After the annual meeting the board of directors met and elected the officers for the ensuing year. W. W. Torrence was elected president in recognition of his valued and untiring service as secretary of the club during the past year, W. M. Scott, vice-president and R. W. Mendenhall, secretary.

SAN FRANCISCO JOVIAN REJUVENATION.

A rejuvenation of the Jovian Order was held at San Francisco on Saturday night, January 10, under the direction of Statesman A. E. Rowe. The ceremony was conducted in the Elks' Hall, which allowed abundant opportunity for an able presentation of the impressive ritual by the following degree team:

Jupiter, A. E. Drendell.
Neptune, A. H. Halloran.
Pluto, F. D. Fagan.
Vulcan, S. L. Hawkins.
Hercules, John R. Cole.
Mars, A. H. Elliott.
Apollo, C. F. Butte.
Avrenim, F. H. Poss.
Mercury, W. W. Hanscom.

The serious aims of Jovianism in developing the value of the individual were set forth by Reigning Vulcan A. H. Halloran. Afterwards refreshments were served and an interesting entertainment of song, stories and pictures provided The following were made rejuvenated beings:

H. G. Aylsworth, vice-president and general manager, Aylsworth Agencies Co.
S. A. L. Baker, Pacific Coast mgr. Macbeth-Evans Glass Co.
P. S. Benjamin, U. S. Steel Products Co.
W. K. Brumfield, president Brumfield Electric Sign Co.
F. I. Du Frane, telephone department, Western Electric Co.
E. D. Eichenlaub, Electric Appliance Co.
G. M. Fisk, chief inspector, Department of Electricity.
E. P. Gibson, agricultural specialist, General Electric Co.
A. M. Jones, salesman John A. Roebling Sons' Co.
Roger Keith, salesman Western Electric Co.
Arthur Kempston, assistant chief Department of Electricity.
R. C. Mixer, motor salesman General Electric Co.
E. R. Murray, salesman Western Electric Co.
E. W. Regensburger, supt. Gas & Electric Appliance Co.
R. E. Smith, supervising engineer, National X-Ray Reflector Co.
C. A. Turner, engineering dept. Pacific Tel. & Tel. Co.
William Weston, chief price clerk Electric Appliance Co.
F. W. Wilson, salesman Standard Underground Cable Co.

INDUSTRIAL SAFETY CONFERENCE.

An industrial safety conference will be held at the University of Nevada, Reno., Nev., on January 26 and 27, 1914, which, on account of the various interests represented and the range of the papers to be presented and discussed, promises to be of great value and interest.

The morning session on Monday, January 26, will be entirely taken up by Railway Apprentice Instructors, who will hold their conference at that time.

At 2 p. m. the same day the meeting will convene with His Excellency, Governor Tasker L. Oddie, as presiding officer. W. R. Scott, general manager Southern Pacific Company, and J. W. Wallace, State Industrial Commissioner, will be the honorary presiding officers.

Papers will be presented by J. J. Mullin, secretary of the State Industrial Commission, on the "Safety First" movement in Nevada; by L. E. Abbott, commissioner of safety, Oregon Short Line, on "Safety First on the Oregon Short Line"; and by Hon. H. F. Bartine, chairman State Public Service Commission, on "Safety Regulations for Electric Power Companies." Ten-minute discussions of these papers will follow by representatives of Nevada-California Power Company, Truckee River General Electric Company, Elko-Lamoille Power Company, Reno Power, Light & Water Company, Esmeralda Power Company and the Pacific Power Company.

This discussion will be followed by an important paper on "Electric Headlights," by J. G. Scrugham, professor of mechanical and electrical engineering, University of Nevada, and will be discussed by delegated representatives of Brotherhood of Locomotive Engineers, Brotherhood of Locomotive Firemen, Brotherhood of Railway Trainmen, Southern Pacific Company, Western Pacific Railroad, Tonopah & Goldfield Railroad, Nevada-California-Oregon Railway and the General Electric Company.

At the evening session to be held at 7:30 o'clock, the presiding officer will be P. E. Raymond, president University of Nevada Engineers' Club. A labor representative, whose name had not been received at the time of going to press, together with H. A. Lemmon, State Industrial Commissioner, will be the honorary presiding officers. The program will consist of (1) Demonstration of Wireless Telephone and of Discharges of High Potential Electricity (2) Motion Pictures—The Manufacture of Steel—Loaned by United States Steel Corporation, (3) of University Campus and Laboratories, and (4) Miner at Work and Mine Explosion and Rescue—Loaned by the U. S. Bureau of Mines.

A special train will also be provided to convey those interested to some point on the line where a series of tests will be conducted under the auspices of the electrical department of the University.

On Tuesday, at 10 a. m., there will be a conference of apprentice instructors.

The electrical section will meet at 1 p. m, and will be presided over by Mr. Raymond, with B. G. McBride, manager Elko-Lamoille Power Company, and C. W. Whitney, Natomas Consolidated of California, as honorary presiding officers. A paper on "The Organization and Development of the Electrical Manufacturing Industry," by R. M. Alvord, manager supply department General Electric Company, will be read.

At the 2 o'clock session Hon. E. S. Farrington, Judge United States Court, will be the presiding officer, with Jno. G. Kircher, president Mine Operators' Association, and a labor representative, as honorary presiding officers. "Industrial Safety" will be presented by W. J. French, Industrial Commissioner State of California; "The Nevada Industrial Commission," by Geo. Thatcher Attorney-General of Nevada; "Accident Prevention in Mines," by Ed. Ryan, State Inspector of Mines, assisted in demonstrations by the mining department of the University; "First Aid to the Injured" will be presented by Professor Peter Frandsen of the University of Nevada, and will be discussed by Dr. O. P. Johnstone, S. K. Morrison and D. McLean. "Safety Precautions of the Nevada Consolidated Copper Company," by Lindsay Duncan, mechanical engineer, and "The National Safety First Congress in New York," by Rev. Lloyd Thomas will conclude the papers.

Then will follow the reading of communications, further motion pictures, loaned by the U. S. Bureau of Mines, and the organization of a State Safety Council.

At 6 p. m. the annual dinner of the University of Nevada Engineers' Club will be held, presided over by Hon. Chas. B. Henderson, Regent of the University of Nevada. Among the speakers will be His Excellency, Tasker L. Oddie, Governor of Nevada; several labor representatives; C. V. Jenkins, business manager Nevada Consolidated Copper Company and Steptoe Valley Mining & Smelting Company; W. R. Scott, general manager Southern Pacific Company, and Dr. J. E. Stubbs, president University of Nevada.

It is largely due to the interest and untiring efforts of Professor Scrugham that this conference on industrial safety has been inaugurated and so successfully lauuched.

TRADE NOTES.

A. L. Parkhurst is erecting a two-story brick building on the northwest corner of Couch and Second street North.

M. L. Glisar is erecting a two-story brick building on the northeast corner of Fifth and Couch streets. Camp & DuPuy. Inc., are builders and architects.

NePage, McKenney & Company have secured the electrical contract for the building on the southeast corner of Fourth and Burnside street, Portland, Oregon.

The building department of the city of Portland, Oregon, has written specifications for the remodeling of the lighting system in the city hall. Bids will be called for shortly.

The Portland Ice Hippodrome, which is being built on the southwest corner of Twentieth street North and Northrup street. Mr. Arthur J. Maclure, architect, 317 Lewis Building.

Fred H. Koltz, 218 Worcester Building, has the electrical contract for the store building and garage located on the northeast corner of Broadway and E. Everett streets, Portland, Oregon.

Condarr-Noonan & Company are agents representing the owners who are erecting a first class theater on the half block on the south side of State street between Park and Seventh streets; seating capacity to be 2200.

Vanderlip & Lord have the electrical contract for the two-story reinforced concrete warehouse being erected for Olson & Rowe Transfer Company, on the southeast corner of Fifteenth street North and Hoyt street, Portland, Oregon.

W. S. Turner, consulting engineer, Spaulding Building, has written the specifications for the lighting and power systems in the Northwest Steel Company's new plant in South Portland. The switchboard is the only portion that will be contracted.

The Novelty Sign Company, San Francisco has been awarded a contract for the construction of an electric sign featuring Heinz 57 varieties. There will he figures on this sign 30 ft. high. It is to be installed on lower Market street.

The Westinghouse Lamp Company announces the removal on January 19, 1914, of its administrative, executive sales, treasury, auditing and purchasing departments from Bloomfield, N. J., to the Martin Building, 1261 Broadway (corner of 31st street), New York City.

Only two bids were submitted on complete equipment for the city power station at Seattle, although several were submitted on separate items. Hunt, Mirk & Company submitted a bid of $139,000, but their bond was unsigned. Chas. C. Moore & Company submitted a bid of $149,000. It is probable that new bids will be called.

The Pacific States Electric Company, Los Angeles branch, have occupied the new quarters recently completed for that concern at 236-38-40 South Los Angeles street. The new store occupies five stories and basement and is in many ways a counterpart of the company's model San Francisco plant, being equipped with all the latest devices for expeditious handling of customers, sample, stock and display rooms, while on the office floor, the system of glass partitions has been adopted.

DIRECTORY OF WESTERN PUBLIC SERVICE COMMISSIONS.

Arizona Corporation Commission, Phoenix, Ariz.

Commissioners:	Officers.
W. P. Geary, Chairman.	Frank De Sousa, Secretary.
A. W. Cole.	Edgar A. Brown, Rate Expert.
F. A. Jones.	Ben Ferguson, Engineer.

California Railroad Commission, San Francisco.

Commissioners:	Officers.
John M. Eshleman, President.	Chas. R. Detrick, Secretary.
H. D. Loveland.	H. H. Sanborn, Rate Expert.
Alex. Gordon.	W. C. Earle, Chief Engineer.
E. O. Edgerton.	L. R. Reynolds, Auditor.
Max Thelen, Attorney.	P. S. Sinsheimer, Bond Expert.

Idaho Public Utilities Commission, Boise, Idaho.

Commissioners:	Officers.
J. A. Blomquist, President.	E. G. Gallet, Secretary.
A. P. Ramstedt.	H. H. Miller, Accountant.
D. W. Standrod.	

Montana Railroad & Public Service Commission, Helena, Mont.

Commissioners:	Officers.
D. Boyle, Chairman.	R. F. McLaren, Secretary.
E. A. Morley.	Oscar Reynolds, Engineer.
J. H. Hall.	

Railroad Commission of Oregon, Salem, Oregon

Commissioners:	Officers.
Frank J. Miller, Chairman.	H. H. Corey, Secretary.
Thomas K. Campbell.	R. H. Dearborn, Utility Eng'r.
Clyde B. Aitchison.	E. W. Moreland, R'way Eng'r.

The Public Service Commission of Washington, Olympia, Wash.

Commissioners:	Officers.
M. M. Godman, Chairman.	J. H. Brown, Secretary.
Arthur A. Lewis.	F. S. Burroughs, Engineer.
Frank P. Spinning.	O. O. Calderhead, Rate Expert.

NEWS NOTES

INCORPORATIONS.

SAN FRANCISCO, CAL.—California Electric Supply Company, $25,000, shares $10 each, subscribed $30, by J. Hepburn, J. F. Walters and R. Hepburn.

SAUSALITO, CAL.—Marin County Electric Railway, $100,000, shares $100 each, subscribed $300, by B. F. Ames, A. Harper and W. W. Hicks, all of San Francisco.

ILLUMINATION.

LAPWAI, IDAHO.—The Lewiston Electric Light & Power Company has applied to the municipal board for a franchise.

SAN FRANCISCO, CAL.—The supervisors have given final passage to the ordinance regulating electric wiring of buildings and installing of electric fixtures.

GLENDIVE, MONT.—Arc lights will be installed on Merrill avenue at an estimated cost of $4500. Elnar Rivenes and Frank C. Huges are the committee on this project.

PORT ANGELES, WASH.—A franchise has been granted to the Olympic Power Company and that company will furnish power as soon as the electric light company announces the substation ready.

AUBURN, WASH.—The commissioners have designated January 27th as the date for hearing the petition of the municipal light plant for a franchise to supply light and power in the White River valley.

BREMERTON, WASH.—A special election has been ordered to vote on the proposition on a proposed municipal light and power plant to cost about $350,000. The project is planned to develop 3000 h.p. with an ultimate capacity of 10,000 h.p.

TUCSON, ARIZ.—Expenditure of $200,000 is contemplated by the Federal Light & Power Company in the improvement of the local lighting and street railway equipment. Projected are several important extensions of electric railway lines, new machinery at the generation plant and new gas mains.

CENTRALIA, WASH.—Acceptance of the franchise granted to the Washington Public Service Corporation by the Thurston County Commissioners to build and operate a system of electric light and power lines through the southeastern part of the county has been made by officials of the corporation. The proposed lines will extend from Olympia through Tenino to Grand Mound and over to Gate City. Light will be furnished to small towns and farmers along the way.

OAKLAND, CAL.—Considerable interest had been centered in a "wireless eye" by which the inventor claimed to be able to pierce the darkness of night for many miles around. The "invention" investigated by the police department revealed that the panorama presented through the machine was the result of the light rays of an incandescent lamp shining through a pin pricked movie film of the surrounding district. The "inventor," who was selling stock in a company formed to exploit the machine, was arrested.

LOS ANGELES, CAL.—The Southern California Edison Company has filed with the railroad commission a new rate schedule which will reduce the cost of service to consumers in Los Angeles, San Bernardino, Riverside, and Orange counties. About twelve months ago the company put into effect a maximum lighting rate of 8 cents per kw.-hr. The reduction resulted in a considerable saving which will be increased by this further reduction to 7 cents per kw.-hr. as the maximum rate. This will bo into effect on March 1st.

TRANSMISSION.

SAN FRANCISCO, CAL.—By a vote of 2 to 1, the Light and Power Council of California decided to abandon the strike maintained since last May against the Pacific Gas and Electric Company.

LACOMBE, ALTA.—This municipality will shortly install an engine type 100 kw. 277 r.p.m., 2300 volt, 3-phase, 60-cycle generator. E. J. Tett is secretary-treasurer and commissioner.

EDMONTON, ALTA.—Offers are being prepared by private companies which purport to be able to supply electric power cheaper than it is being generated by the municipal plant. It is proposed by one of these companies to generate the power at the pit mouth of a nearby coal mine and transmit it over high tension lines to this city.

LOS ANGELES, CAL.—The Vernon substation of the Pacific Light & Power Company was completely destroyed last week by fire caused it is thought, through lightning. Notwithstanding the fact that this substation carries more than 50 per cent of the load, it was but a few hours before normal traffic conditions were restored.

SAN FRANCISCO, CAL.—The works board has been advised by the city attorney that it has no right to refuse to a public service corporation a permit to open streets which it already occupies, if the corporation makes the necessary deposit as provided by the ordinance regulating the opening of streets and otherwise complies with the ordinance.

TULARE, CAL.—The Mt. Whitney Power & Electric Company is making a survey for a transmission line from No. 3 plant direct to Lindsay. This will be a steel tower construction following the present line to Lemon Cove, thence in a straight line to Lindsay. Actual construction will begin shortly. All construction work on the Wolverton dam project has been abandoned for the winter and will not be resumed until some time in April.

LOS ANGELES, CAL.—The Southern California Edison Company is building 12 miles of road in San Bernardino county, at an estimated cost of $100,000 preparatory to expending $1,000,000 for two additional generating power plants. The work includes 8 miles of concrete line flumes and tunnels, and parts of the road will go straight through rocky cones. All work is being done by the Edison company at present, but it is probable that the rock drilling will be let by contract.

GREAT FALLS, MONT.—There has been filed in the county recorder's office here a mortgage whereby the Montana Power Company places a lien upon its properties in this state to the extent of $75,000,000 in favor of the Guaranty Trust Company of New York. It was explained by John G. Morony, vice-president of the power company, that the mortgage was given in security for bonds dated July 1, 1913, and falling due on July 1, 1943, to the amount of $17,000,000, and such other bonds as may be issued by the company from time to time. The company is the owner of several power plants at various points in the state, including two at Great Falls.

FRESNO, CAL.—The new Tule River plant of the San Joaquin Light & Power Company has been put into operation, although some finishing work remains to be done. It will greatly relieve the strain under which the company has been operating, as a result of the two dry spells in the San Joaquin Valley. The recent rains have poured large quantities of water into Crane Valley Lake, the main reservoir of the company, and it is rising rapidly. Reports from the mountains indicate that there is a heavy mantle of snow on the hills above the lake, and as there are prospects for more snow before the winter season is over, the power company people express the belief that there will be plenty of water in Crane Valley Lake for all requirements next summer and fall.

MURRAY, UTAH.—The Progress Company of Murray has entered into a contract with Murray city whereby all of the surplus power from the municipal plant, the installation of

which has just been completed by the city, will be taken by the Progress company. At the same time a joint pole line agreement was entered into between the Progress company and the city whereby each has the right to use the poles of the other for stringing its wires. These two contracts appear to afford a fairly satisfactory solution of the situation which has recently arisen as a result of the installation of the municipal plant. The municipality does not agree to change its former plan of supplying electric street lighting and commercial electric service within the corporate limits of Murray City, but owing to the fact that they receive a fairly good price for their surplus power, they will not find it advantageous to extend operations to the surrounding communities. The contract will provide for a rate of $3.50 per kilowatt per month on the basis of the maximum demand used.

TRANSPORTATION.

NELSON, B. C.—At the January elections, by-laws will be submitted authorizing the raising of $30,000 to pay debts and provide for improvements on the street railway system.

SAN FRANCISCO, CAL.—The quarterly report of the California Street Cable Railway for the three months ended September 30 shows but four accidents. Three of these were slight in character.

SAN FRANCISCO, CAL.—A resolution was adopted by the supervisors requesting the United Railroads to build and operate a street railway upon Richmond avenue, between Mission and Andover streets, in accordance with a franchise granted in 1892, and passed to print.

SALT LAKE CITY, UTAH.—The Utah Light & Railway Company announces that on account of the rapidly increasing business on its interurban line to Holliday ten miles southeast from the city, the service on this line will be practically doubled during 1914.

MISSOULA, MONT.—The Chicago, Milwaukee & St. Paul has decided to proceed with a part of its elaborate electrification project. It will electrify one engine district from Deer Lodge to Three Forks, 113 miles, with sidings and yards. There will be a total of 168 miles of tracks. Direct current will be used with overhead trolley construction.

EL PASO, TEXAS.—Cloudcroft's electric line from mountain resort to Hope and Artesia is again under serious consideration, and a party of Illinois and Kansas City capitalists is expected in Cloudcroft shortly to go over the route of the proposed Cloudcroft-Pecos Valley Electric line. The proposed line will be about 90 miles long.

TACOMA, WASH.—Tacoma citizens rejected an $87,000 bond issue proposed to build a street car line across the tideflats. Regardless of the defeat of the $87,000 bond issue the city council concurred in an ordinance introduced by Commissioner A. U. Mills providing for a fund from which $35,000 in warrants will be issued for the construction of a street railway by the city across Eleventh street bridge to the tideflats.

SAN FRANCISCO, CAL.—City Treasurer McDougald reports that the Crocker National Bank has bought Municipal Railway 5 per cent bonds to the amount of $200,000 and that a purchase of $50,000 has been made by Adams & Company of New York. The supervisors recently authorized the city treasurer to sell these bonds to the amount of $653,000 at a price which would make the net interest 4.90 per cent, thus calling for a small premium. The sales now aggregate $525,000, McDougald says, leaving $128,000 still on hand.

BAKERSFIELD, CAL.—Word comes from San Luis Obispo that W. P. Early of Petaluma and A. D. Bowen, a railway promoter of San Francisco have broached the proposition of an electric line from that city to Bakersfield, and have outlined plans for a survey according to the most feasible routes. A meeting was held at which Mayor McAllister of San Luis Obispo presided and which was attended by a number of prominent business men and capitalists, when the proposition was discussed and was given hearty approval.

SACRAMENTO, CAL.—President Arnstein and Vice-President S. Napthaly of the Oakland, Antioch & Eastern Railroad, were in Sacramento recently on business connected with the construction of the new depot on the present site, which has a frontage of 75 ft. on third street adjoining the Commercial Hotel at Third and I streets. Plans are completed for a 2-story structure which will cover the entire lot, embracing an area of 75x150 ft. The structure will be built of stone and steel. The upper stories will be devoted to company offices.

TACOMA, WASH.—A total of $1,800,000 will be spent by railroads entering Tacoma during 1914 for extensions, improvements and enlargements of terminal facilities. One million dollars of this amount will be spent for the completion of the Port Defiance line, $375,000 for the Oregon-Washington Railway & Navigation Company's viadust across the city waterway, $250,000 for the Northern Pacific viaducts, $125,000 for the Oregon-Washington Railway & Navigation Company's fireproof freight sheds on the Tidelands, $30,000 for the new commercial dock bridge of the Northern Pacific and $20,000 for the Northern Pacific terminal yards.

PORTLAND, ORE.—Judge R. S. Bean in the federal district court, today issued an interlocutory injunction restraining the city council of Portland from enforcing an ordinance recently passed providing for the sale of street car tickets by the local transportation company at the rate of six for 25 cents. The court pointed out the fact that the remedy for the city to pursue would be in the application to the tribunal created by the public utility act enacted by the legislature last winter vesting the railroad commission of Oregon with power to regulate every public utility in the state and further that while the city possessed certain powers, the federal court had power to correct transgressions when the city encroached upon the powers of the state.

SAN FRANCISCO, CAL.—For the purpose of providing funds necessary to change the motive power of the Ocean Shore Railroad from steam to electricity, the general stockholders in that corporation unanimously voted to issue 5 per cent bonds in the sum of $5,000,000. Of the total issue the first $200,000 subscribed will be used for making the contemplated change and equipping for electric service that portion of the railroads operating between San Francisco and Halfmoon Bay. This $200,000 has already been pledged. The remainder is not expected to reach the market for the present. The substitution of electricity for steam will considerably reduce the operating cost of the road, and at the same time will provide more frequent and rapid transportation.

TELEPHONE AND TELEGRAPH.

RIVERSIDE, CAL.—The common council has awarded a telephone franchise to the Pacific Telephone and Telegraph Company for one year, dating from March 1st.

AZUSA, CAL.—Manager F. M. Wright of the Covina Telephone Company states that a number of improvements are to be made in Azusa in connection with their lines, to cost about $4000.

SILVER CITY, N. M.—The Mountain States Telephone Company is considering the installation of a new telephone line to Mogollon and the establishment of a telephone exchange there.

SAN FRANCISCO, CAL.—Judge Seawell has made permanent an injunction issued in 1908, by which the Commercial Pacific Cable Company is restrained from charging a transfer rate on messages filed at San Francisco by the Western Union Telegraph Company for transmission to the Orient. The cable company is restrained from charging such rates at all points where the Western Union is in competition with the Postal Union Company.

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BY W. D. PEASLEE.

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BY A. L. POWELL.

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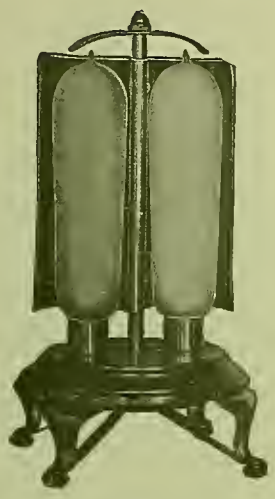
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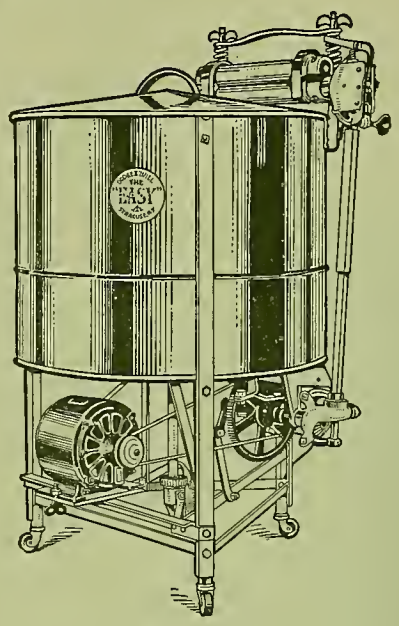


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POWER AND GAS
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VOLUME XXXII SAN FRANCISCO, JANUARY 24, 1913 NUMBER 4

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ELECTRIC STIMULATION OF PLANT GROWTH

BY W. D. PEASLEE.

(This analysis of the effect of electric stimulation of plant growth as observed from experiments with several methods, has resulted in data of interest and importance. The author hopes that those more advantageously equipped for this work will make further investigations along this line.—The Editors.)

It is a well known economic principle that the stability of a country is largely dependent on the ability of the soil to support the population, or in other words, upon its agricultural productivity. The increasing tendency towards the application of scientific methods to all agricultural work, and the establishment of agricultural colleges and departments of agriculture in the large universities is a movement in recognition of this principle. Intensive cultivation is one of the most fruitful methods of increasing the unit agricultural output of the soil.

Early in 1910 the writer took up the study of stimulation of plant growth and was soon led to an investigation of electrical methods as a solution of this problem. In offering here some of the results of the experiments that have been carried on since then, and the theory developed from a study of these and other results, it is hoped that the data presented may be of interest to many and of some value to those who are working along the same lines.



Comparative Illustrations of Stimulated and Unstimulated Plant Growth

Fig. 2. (Beets).
Print of two average plants, 21 days after planting. Current, direct, .00082 amp./sq. in.; 1.06 watts per cu. ft.; 507 watthours per cu. ft.; increase in size, average of 100 plants, 10 per cent.

Fig. 3. (Cauliflower).
Print of two average plants, 17 days after planting. Current, direct, .00009 amp./sq. in; .03 watts per cu. ft.; 10.08 watthours per cu. ft. Increase in size, average 50 plants, 29 per cent. Fertility; electrified 87.7 per cent; non-electrified 65.3 per cent.

Fig. 4. (Cabbage).
Print of two average cabbage plants, 17 days after planting. Current, direct, .00011 amp./sq. in.; .036 watts per cu. ft.; 12.2 watthours per cu. ft.; increase in size, average 100 plants, 52.9 per cent. Fertility; electrified 93.3 per cent.; non-electrified, 58.3 per cent.

Experiments were first undertaken to establish the result of a current passing through the soil containing the seeds or roots of plants. This procedure was on the theory that any results that might be obtained would be due to an enrichment of the soil in the nitrogenous compounds necessary to plant life, by the

chemical action of the current. Many tests were made, most of them at first failures, with various current densities. The two principal causes of failure were too high current densities and the use of electrodes that, decomposing electrolitically, filled the soil with salts injurious to plant life. Carbon was finally adopted as the best electrode material.

Seeds were planted in boxes containing earth from the same mixer and were kept under identical conditions as to temperature, water applied, etc., except that some were subjected to the influence of

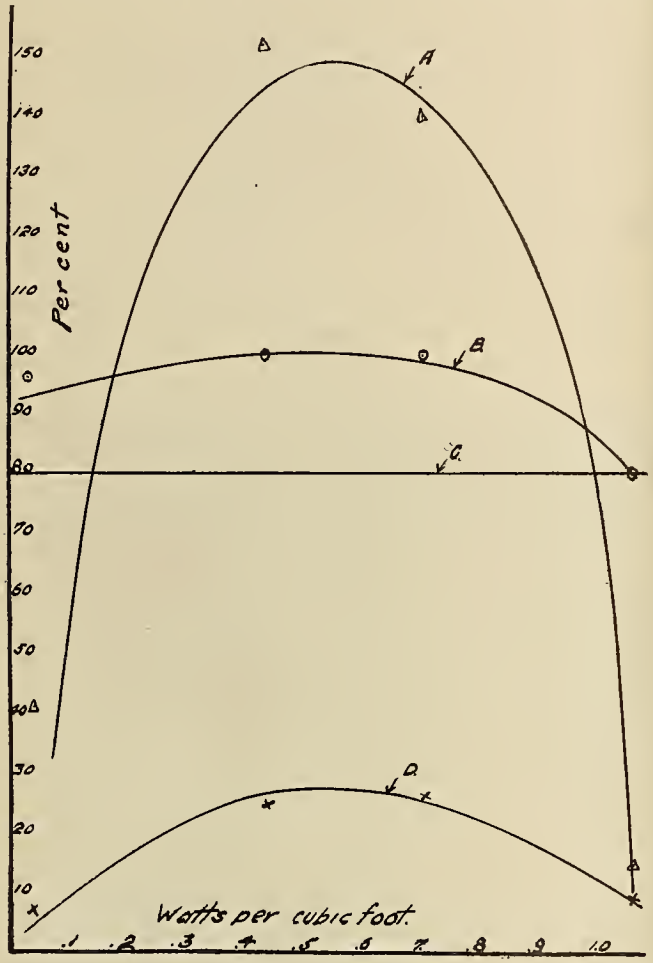


Fig. 1. (Cauliflower).

(A) Size of electrified plants in per cent of size of non-electrified when the latter are ready for transplanting.
(B) Fertility in per cent of electrified seeds.
(C) Fertility in per cent of non-electrified seeds.
(D) Length of time taken by ordinary plant to attain a size suitable for transplanting over time taken by electrified plant.

direct electric currents through the soil while others, used for comparison, were allowed to grow in the usual way. These tests were carried on in a greenhouse and were continued until the non-electrified plants were ready for transplanting to the greenhouse beds. The number of seeds planted in each box were carefully noted as well as the number sprouting to discover any effect the treatment might have on the fertility of the seeds. At the end of each test careful measurements of each plant were made and the results averaged. The data from all the tests has been averaged and studied for principles that might be indicated. Fig. 1 shows a set of curves derived from a great many tests on cauliflower. It should be mentioned here that the curves for other plants such as cabbage or beets, while quantitatively different, have the same typical shape.

When the tests were concluded average plants were pressed and preserved and prints taken of them. Typical specimens are shown Figs. 2, 3 and 4. In these it will be noted that the principal gain is in the root structure, a very desirable end in plants that are to be transplanted. On this account the improvement of the electrified plants was greater than indicated by the percentages shown. It was also noted that the electrified plants, after transplanting, were more hardy and grew faster than the non-electrified, with no further stimulation for either.

Fig. 5 is a photograph of radishes wherein the test was continued until the electrified plants were of a marketable size, the twelve largest plants from the non-electrified bed and the twelve average from the



Fig. 5. (Radishes).
Current, .00014 amp./sq. in., direct; .444 watts per cu. ft.; watthours per cu. ft. 192. Fertility; electrified, 100 per cent; non-electrified, 92 per cent.

electrified bed. None of the non-electrified plants were of marketable size while all the electrified plants were. One was 1½ in. in diameter, and of fine flavor, not, as might be expected, pithy or strong. After the photograph was taken the tops were cut off and weighed, the results being as follows:

Electrified	6.75 oz.
Non-electrified	3.1 oz.
Gain electrified	3.65 oz. or 117 per cent

The roots were then washed and weighed.

Electrified averaged for 25 plants	0.468 oz. each
Non-electrified averaged for 23 plants	0.098 oz. each

This is a gain of 403 per cent in the average size of the edible portion of the plant.

As the test was not continued till the non-electrified plants were of marketable size no results as to the time saved can be given for this test but other tests carried out for that purpose indicate that the excess time taken by the non-electrified plants over the electrified at this value of watts per cubic foot is about 34 per cent.

The prints and photographs shown are selected from a great many tests and are not the best that were obtained but are, as nearly as could be selected, average results under the conditions shown.

Similar tests were made with alternating current 60 cycles and the results were at first rather startling as they were consistently negative. It was finally found that they were positive at very low values of watts per cu. ft. The results of one test on cabbage plants being:

Current .....0.000034 amp. per sq. in.
Power .....0.0114 watts per cu. ft.
Increase in size electrified over non-electrified (average of 40 plants) was 32 per cent.
Fertility electrified—91.3 per cent.
Fertility non-electrified—69.4 per cent.

A comparison of these results with Fig. 4 will show the effect mentioned.

Later, experiments were begun to ascertain the effect of applying a voltage stress to the atmosphere around the plants. After germination the plants were subjected to a constant charge of about 100,000 volts as indicated by a needle gap, with the wires 10 in. from the soil, giving about 10,000 volts per inch stress in the air around the plants. A Wimshurst machine was used to maintain this pressure and tests were made using both positive and negative as the ground to see if any difference in effect could be observed. At first the results, as far as the plants were concerned, were disastrous. It was then found that by applying the pressure only on cloudy days and at night good results could be secured. Finally, after a better understanding of the principles involved was attained, some very remarkable results were secured.

An average of five tests on strawberries showed an increase in size of the electrified over the non-electrified of 27 per cent. Beets showed an increase in size of 14 per cent in the roots and 39 per cent in the tops.

Many tests have been made at different pressures per inch but it seems at present impossible to establish any direct relation between the gain in size of the treated plants and the pressure per inch that is applied. Two points were established, however, that are of great value.

First, no difference in stimulative effect was found when using positive or negative as the ground. This is very gratifying in view of the conflicting results of Lemstrom and Sir Oliver Lodge. The former found that with the ground negative, increased growth was obtained and that a positive ground was harmful to the plants, while the latter found increased growth with either connection. However, the published results of these investigations are very meager, so we are unable to have the privilege of a close analysis of their results. This fact is of great value as it points at once to the use of alternating pressures and permits the employment of a transformer to give the high pressures necessary rather than the erratic influence machine.

Second, there is some tendency to show for all plants a curve approximating a straight line within certain limits, Fig. 6. The slope of this curve is different for each plant and might well be called the "susceptibility factor" of the plant. There is not yet sufficient data at hand to make it possible to more than show the general shape of this curve. This will be readily appreciated when it is remembered that any change in time of an application of the pressure, humidity, etc., will change the results secured and the greatest care is necessary in analyzing the results of different tests. It seems that the best time of application is on cloudy days and at night. Climatic differences will therefore render the results of two otherwise identical tests, very different. It will be seen that a great deal of data is necessary and the greatest care in analyzing it or conclusions will be drawn that may prove confusing.

Tests were then carried on using a Tesla coil outfit in place of the Wimshurst machine and while considerable data has been secured it has not been possible so far to establish anything more than the qualitative fact that an increase in size within about the same limits as with the Wimshurst machine is obtained.

The theory at first held was that the effect shown was due entirely to a chemical action of the current

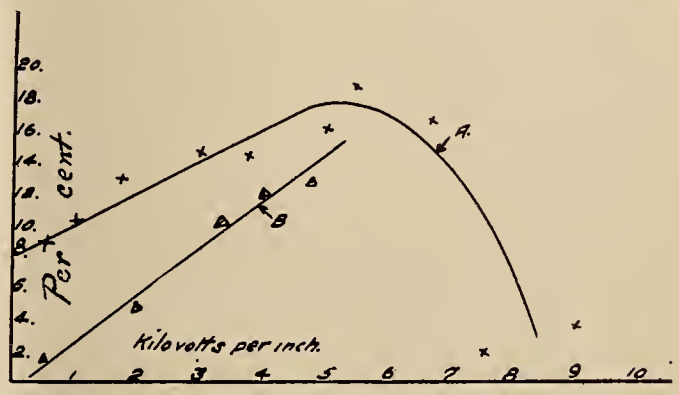


Fig. 6.
(A) Increase in size of electrified over non-electrified plants under stimulus of electrostatically stressed atmosphere. Beets.
(B) Same as A except for Cauliflower.

in increasing the nitrogenous content of the soil, or in the case of atmospheric stress, the driving of nitrogen from the air into the ground. This theory was soon abandoned as, while the effects mentioned were experimentally established, the amount of nitrogen that can be added to the soil in this way is not sufficient to bring about the results secured.

A study of plant life, especially from a psychological point of view was then begun. For information on this subject very grateful recognition is given Mr. J. C. Bose of Calcutta whose work, "Plant Response as a Means of Physiological Investigation," furnished the information that led to the clearing up of the most perplexing points brought out by the tests.

Mr. Bose established by long experiment two laws of plant growth:

1. Direct application of a stimulus, inducing contraction, retards growth.

2. The effect of indirect stimulation is to increase the internal energy and thereby augment the growth.

This indirect stimulation may be:

(a) Stimulation of the root tip: 1, mechanically; 2, electrically, 3, chemically.

(b) Direct stimulation of a distant point, thus causing a wave of positive turgidity variation to be transmitted to the responding organ, if the stimulated point is at a sufficient distance from the disturbance to prevent the effect of the direct stimulation reaching the growing organ, since the effect of a direct stimulation of a growing organ is to induce a negative turgidity variation with a concommittant retardation of growth.

However the energy absorbed from an external direct stimulus may, as an after effect, increase the internal energy of the plant resulting in an accelera-

tion of growth after the removal of the stimulus. This is the indirect effect of direct stimulus and the action of sunlight is a good example. The direct action of sunlight is to reduce the growth rate but after this direct stimulus is removed the rate of growth increases. Fig. 7. This is a curve taken from the above mentioned work of Mr. Bose and shows this after effect very markedly. The growth rate is decreasing while the plant is subject to the direct stimulus of sunlight,

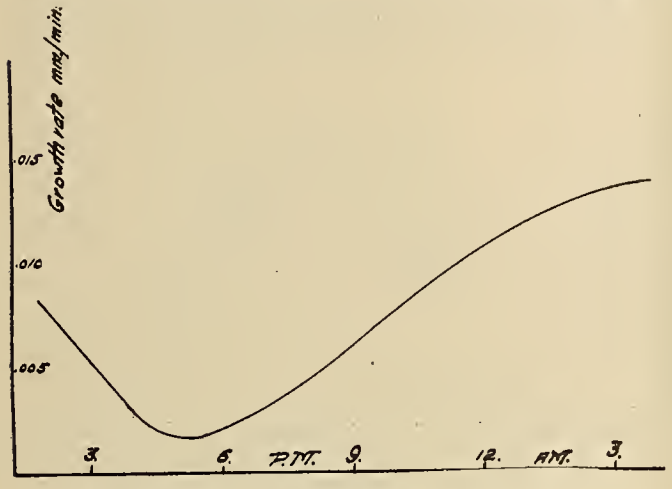


Fig. 7. Effect of direct light stimulation on rate of growth.

and as soon as this direct stimulus is removed the internal energy thus stored accelerates the growth during the early hours of the night, the growth rate falling off towards morning as the stored energy is exhausted.

The effect of a change of temperature might at first be taken for a response to stimulus but Mr. Bose has shown in a striking manner that it is what he calls the "Optimum Effect," i. e. a change in the excitability, which is at its maximum at a definite point for each plant. For tropical plants this point may be determined very closely as indicated by Fig. 8, which is a growth rate temperature curve of a cirnum lily subject to the same stimulus at different temperatures, A plant of the temperate regions would have a much flatter curve and would break gradually at the optimum point rather than in the abrupt manner shown.

Mr. Bose also found that a transverse electric current will excite the root tips with a consequent increase of growth rate, but the currents must be small or the excitation will induce fatigue. This fatigue effect was found very marked and an examination of Fig. 1 will confirm this statement further.

Another effect of currents in the soil is that a plate source of current is a direct stimulation of a distant point and this causes a wave of positive turgidity variation to be transmitted to the roots increasing their functional activity. In other words, it is a direct stimulation of a distant point.

Hertzian waves, as light, are a direct stimulus and retarded growth as would be expected, but the after effect is to increase growth rate.

From the results of Bose's work and the tests herein described the following principles have been established.

1. The direct stimulation of a distant point, i. e. the indirect stimulation of the root or plant induces a wave of positive turgidity variation and thus increases the functional activity of the organs if they are far enough from the point of application of the stimulus to avoid the effect of direct stimulation.

2. Though the immediate effect of direct stimulation is to cause a negative turgidity variation and retard growth it increases the internal energy of the plant and the after effect is to increase the growth rate.

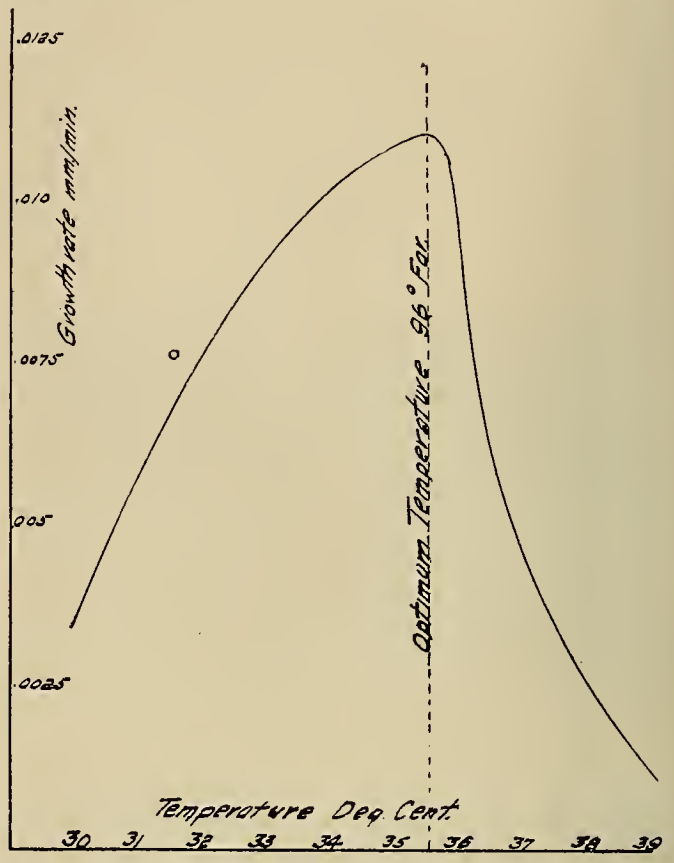


Fig. 8. Effect of temperature on excitability of Cirnum Lily.

3. Plants are very sensitive to fatigue and the stimulation must be of such degree and duration that fatigue is avoided if the net result of the treatment is to be beneficial.

It should be noted how uniformly the curves indicate this fatigue effect, Figs. 1 and 6. It is also shown in the effect of alternating current in the soil, indicating that the stimulative effect of a given alternating current in the soil is greater than that of the same current density of direct current.

It is earnestly hoped that investigators more advantageously equipped will continue these and other experiments in this field establishing or altering the above theory so that we may have definite principles by which the effect of a given stimulus may be predicted with the accuracy obtainable in scientific and engineering work.

Panama Canal excavation aggregates, according to the most recently compiled statistics 242,533,216 cu. yd. which does not include 48,238,960 cu. yd. excavated by French companies but not useful to the present canal construction. It is estimated that 19,727,784 cu. yd. of earth are yet to be excavated.

EFFECT OF FORESTS ON RUN-OFF.

BY J. C. STEVENS.
(Continued.)

Percolation.—Liberal percolation of water into the underlying soil is a necessary factor for uniformity of stream flow. We may consider the humus and the soil under a forest as two media of different porosity. If the humus is more porous than the soil, percolation into the soil will be favored; but if the soil is more porous than the humus, less water will percolate than if the soil were directly exposed. A saturated strata is impervious to water, hence in a fine soil the upper layer may become saturated and held in place by capillary action in the overlying humus. In this condition, any additional water simply runs off. The term humus is taken to include all the litter from the surface of the forest floor to the soil underneath it. The upper layers are coarse twigs, leaves, needles, etc., giving place to rotten wood, leaf- and wood-fibers intermingled, and gradually merging into a fine dust-like mold, and finally into the main soil itself. Percolation is the result of two forces, gravity acting downward, and capillarity acting upward. Gravitational forces are constant in all soils, while the finer the soil the greater the force of capillarity. In gravel it is practically negligible, in fine clay it may effectively prevent percolation. If, then, a fine mold overtops a porous soil, less water will percolate than if the porous soil were directly exposed. On a compact soil the mold cannot increase percolation except by arresting the lateral motion of the water and allowing the force of gravity to act longer. In compact soils the amount of percolation is never very great, and the increment due to a humus cover is of the second order of magnitude and can scarcely be of economic importance.

The general claim that the humus gives up its water is directly contrary to physical laws. The forest cover has been likened to a sponge that fills with water which it gradually pays out to the streams. The fallacy of this theory is evident upon reflection. Water does not drain from a saturated sponge except when more water is added. It holds all it receives until saturated. So with the humus (except that the humus is very far from being anything like a sponge); it holds its water until saturated, then water begins to run off and percolate. If the supply is less than sufficient to saturate, the water is evaporated gradually and little or no percolation takes place.

Experiments to determine the amount of rain-water percolating through various soils with various covers have been conducted in European countries, but to the present time no absolute conclusions have been reached on the effect of humus. Dr. Ernest Ebermayer, from a long series of experiments in Bavaria, comes to the conclusion that deep humus imbibes almost all percolation and gives up very little water below. He says: "If our earth were covered with a humus soil of one meter in depth, subterranean drainage would be so slim that springs would be scanty and continuous flowing springs absent."

Very elaborate and careful researches by Dr. Otosky on the steppes and forest lands of Russia, by Professor Morasof in the fir forest of Khrienof, and by Professor Henry of the forest school of Nancy, in the Mendon Forest, France, and by other observations in both Europe and American countries, have demonstrated conclusively that the ground water in forests is at a lower elevation than in the open country. This results from the fact that the trees require large quantities of water for their sustenance and growth. The trees literally "pump" water from the ground and dissipate it by transpiration, and this property has even been put to use in the artificial drainage of marshes. Mr. Lokhtine, in a paper presented to the Tenth International Navigation Congress, held at Milan in 1905, says:

"As a general rule standing on these observations (those of Otosky, Morasof, Henry and others) it seems as though it could be considered as proved that the forest evaporating into the air a large amount of water and withdrawing it from the ground by means of its roots, dries the stratum of the ground into which its roots penetrate, and draws down the level of the subterranean waters. Whence this conclusion, opposed to the former view, that not only does the forest not preserve moisture for the supply of brooks and rivers, but it actually does them harm in this respect. The forest is no longer considered as having more than a certain usefulness in holding back the run-off of surface water. This is the conclusion at which Professor Volny, for example, arrived, and the venerable sylviculture specialist, Mr. Ebermayer, has spoken of it in the same way, although it was on his authority that reliance used to be placed to demonstrate the utility of forests for supplying rivers. He has now changed his opinion and admits that it was incorrect, at least so far as flat countries are concerned. "Forests," he says, "do not increase the quantity of water in springs, but reduce it."

Opposed to this eminently scientific view is the general belief that small springs generally dry up following the removal of forests, but on this point the evidence is so conflicting that no conclusions are possible. My own opinion, gathered from the observation and study of a great mass of literature on the subject, is that a humus cover on soil does not materially affect the amount of percolation one way or the other. On porous soil the humus tends to discourage percolation, while it may increase it slightly on a compact soil; but in either event the increment or decrement for which the humus alone is responsible is of no material value. If this is true the amount that floods are diminished and low stages augmented, is limited to the water-holding capacity of the humus itself. This capacity is very small, and the amount retained from a shower will depend upon its previous condition of saturation. It takes very little rain to saturate a forest litter, and once saturated its power to prevent run-off is exhausted. Moreover, the value of forest litter in this respect must be measured, not by its absolute capacity, but by its capacity in excess of that of naked soil. The results of Dr. Ebermayer's experiments[1] are illuminating on this point. He found that the capacity of the litter in a spruce forest 120 years old was virtually twice that of the naked soil (similar to that under the litter) for the first two inches of depth, but for greater depth the naked soil had slightly greater holding capacity.

The larger openings between sticks and twigs cannot hold a great deal of water. The capacity of

[1]Bulletin No. 7, "Forest Influences," page 146.

humus, therefore, is concentrated in its lower part or in the vegetable mold lying between the soil and this coarser litter. This mold is so light that on steep slopes it does not accumulate to any extent, but is washed into the flatter portions of the area. The total volume and hence the capacity of this layer of water-bearing mold even on an old forested area is utterly insignificant when compared with the volume and water-holding capacity of all the soil and rock formations composing the area. Even in the older forests this mold can never have a volume greater than about 1/10,000 part of the volume of the drainage area, and any increased capacity in the holding power of this slight volume is utterly negligible. Moreover, the needles of conifers and leaves of deciduous trees frequently form a veritable thatch over the litter and humus that allows water to run off without even wetting it. This, of course, is most marked on sloping ground.

The statement is frequently made that a forest litter keeps the soil underneath granular and makes it more susceptible to percolation. That this is contrary to physical laws is also evident upon reflection. The soil of an area must sustain the weight of the trees and the stress produced by winds. In a mature forest from 3 to 5 per cent of the area at the surface of the ground is solid wood. For the first two feet under the surface the quantity of wood is probably 6 or 7 per cent, and all of this soil is compacted into a tight band between the tree roots. Ocular evidence of this is displayed by the masses of earth and boulders that cling to the roots of upturned trees. Such a mass is frequently ten or twenty times the area of the tree trunk, and sometimes resists the erosion of rains and winds for years. Such soil exists under every tree, and it is more than likely that in dense forests 25 to 30 per cent of the soil area is thus compacted into a solid mass. Such a soil is far from granular, and is not conducive to percolation.

With a given quality of soil, the fallow field is the most receptive to percolating water. Meadow lands and pastures are probably second in order, with brush land third, and dense forest fourth.

Evaporation and Transpiration.

These two phenomena in the realm of science are entirely separate and distinct, but for the purposes of studying forest effects they can be considered together.

The water dissipated by evaporation, exhaled by plants, and absorbed by plant growth, represents certain losses that reduce the quantity available for percolation and run-off.

Under forest shade and wind protection, the evaporation from a water surface and from continually wet soil and litter is about one-half[2] that from similar surfaces in the open. Now the absolute evaporation from water surfaces in the United States varies from 30 to 100 in., and in arid and semi-arid regions is ever greater than the annual precipitation. If an annual rainfall of 40 in., say, was uniformly distributed throughout the year (0.11 in. per day) it would practically all evaporate. That it does not is due to the fact that the rain is not uniformly distributed, and the percentage of precipitation that does evaporate is seen to depend almost entirely upon the distribution of rainfall and the climatic influences attending it, while the character of the land surface is of secondary importance. In other words, the amount actually evaporated is governed by the amount of water available for evaporation. This is also true of transpiration. Plants transpire in proportion to the amount of water at their disposal. In a coniferous forest, under average conditions of rainfall, the transpiration is equivalent to from five to ten inches[3] over the area of the forest. If the roots are plentifully supplied with water, trees may transpire several times this amount; or in a dryer soil they may transpire only a fraction thereof, and still live.

The action of a forest cover in this regard must be weighed against that of the open field. After a shower falls in the open, evaporation proceeds at a rapid rate until the upper film of soil is dry, then it gradually diminishes. The grasses and small vegetation continue to transpire water from the upper layer of soil into which their roots penetrate, at a continually decreasing rate. In the forest, on the other hand, a considerable portion is caught in the tree crowns. After a shower the tree tops first dry out at a rapid rate, then evaporation continues from the litter, etc., at about half the rate in the open, but continues for a longer time. Now in every forest there is usually a heavy growth of underbrush, grasses, etc.—frequently as much small plant life as is found in the open—and these transpire large quantities of water from the litter and upper layers of soil, while the deeper roots of the large trees draw from greater depths. Hence, compared with the open, the forest in general evaporates and transpires greater quantities of water than the open field, but from the fact that evaporation takes place at a slower rate in the forest, wooded glades are usually moist, not having an opportunity to dry out between showers. Because of this occular evidence of moisture, the conclusion is hastily drawn that the forest is a great conserver of water, when, as a matter of fact, this moisture in evidence in the forest would either have run-off or percolated into the soil if the forest were not there.

Whatever moisture is evaporated or transpired from an area is lost to the water supply of that region. It depends on conditions, whether this reduction is useful or harmful. Any increase in percolation goes to increase the uniformity of the yield, and uniformity usually is a desirable element in the utilization of water supplies.

Effect on Rainfall.

Until recent years it was quite generally believed that forests increased precipitation. Even the most ardent advocates of that theory now generally admit that forests are the result and not the cause of rainfall, and that they do not influence the distribution of rainfall to any appreciable degree.

The physical causes of rain are not fully understood, but it is certain that the moisture in the air can not be precipitated until the air is cooled below the "dew-point." Air will hold just so much water vapor at a particular temperature. Therefore if sat-

[2] Ibid p. 96-102 and 132-135.

[3] Ibid p. 81.

urated air is cooled, part of the vapor is "squeezed out" of the air. If the cooling is slow, the vapor forms clouds or mist; if rapid, it forms drops which fall as rain or snow. Any influence which tends to cool large volumes of saturated air suddenly may cause rainfall. The most potent influence is dynamic cooling, i. e. by rising to heights where the pressure is less, allowing sudden cooling of air by adiabatic expansion, thus the windward side of mountain slopes deflect the winds upward, and hence receive a large amount of precipitation if these winds are saturated.

Now if forest cover induces rainfall, it must do it by appreciably increasing evaporation, which increase must be precipitated over the same region, or the forest area by some peculiarity must divert rain to itself that otherwise would fall elsewhere. Now forests do generally increase evaporation, but it is never a sufficient increase to materially affect the saturation of the air over them; yet it is plainly evident that to increase rainfall by increased evaporation, the increase in evaporation must materially affect the condition of saturation of the surrounding air. On the second point it is hardly possible that the slight difference in temperature over the forest will produce dynamic cooling of air sufficient to induce rain.

Data on relative amounts of rainfall over forests and open land have been gathered for half a century or more. Only one conclusion can be drawn from them—that if this increase exists, it is less than the observational errors of the methods used, and hence is unimportant economically.

The mechanical effect of forests on precipitation, however, is not negligible. The first important truth is that the tree crowns catch considerable precipitation and dissipate it by evaporation. The long series of European experiments have shown that forest crowns catch about 25 per cent of the annual precipitation. In other words, only about three-fourths of the rainfall reaches the humus and litter. The exact amount of course depends upon the intensity of precipitation. The amount required to saturate the leaves and branches of a forest may be a larger percentage of a light summer shower, but would be an immaterial part of a heavy rainstorm.

The second feature for consideration is the mechanical retarding effect of the litter and underbrush on the run-off. Here again this effect must be weighed against that of the open field. The retarding influence of a sod or of a rocky slope is just as great as that of a forest litter. Under the leaves, twigs and debris of a forest floor, the water filters to lower levels just as surely and as rapidly as it will over the roughened surface of an open hillside with its attendant growth of grasses, weeds or small brush. Among large trees the mechanical retardation is much less than among the tangled undergrowth of open brushland. Moreover, such retarding effect can scarcely be useful even if it existed. Suppose it takes water 30 minutes to run down an open hillside, and suppose that if the same hillside were covered with forest and litter the time would be doubled, the maximum rate of flow in the stream at the foot of the hill would be just as great in the one case as in the other, only it may be delayed a matter of minutes, or hours at most. To make streamflow more uniform the retardation must be effective over much longer periods of time—weeks or months rather than minutes.

Effect on Snowfall.

The mechanical effect of a forest on snowfall is of special importance. It is generally believed that because of the shade, wind protection and reduced temperatures within a forest, melting of snow is greatly prolonged and that the uniformity of run-off is consequently improved both by increased percolation induced and by the continued supply from slowly melting snow fields.

The advantages to percolation from melting snow are no greater than from rains. Snow itself will not percolate until melting occurs, and then the action under a forest litter is in no wise different than if the water were newly precipitated. This feature has already been discussed.

The mechanical influences of trees on snowfall are well known. The initial fall is caught in the crowns. If snow is dry and accompanied by wind, comparatively little is caught in the trees, but if the snow is damp enormous quantities are held in the branches. As much as six or ten inches of soggy snow may lodge in the trees and evaporate directly, none of it reaching the ground. Evaporation from snow is almost as rapid as from a water surface, and especially so when suspended in the trees, becaues of the greatly increased surface exposed. Thus, generally, the forest floor receives less snow than that in the open, as in the case of rainfall. But when snow does reach the ground it forms an even blanket over the surface and no appreciable drifting occurs. The longer the snow lies the more compact it becomes. A layer of snow five feet in thickness may in a few months of ordinary weather shrink to two feet without producing enough water to wet the ground underneath or causing any run-off. This is also true of snow in the open.

In the open land, however, the winds have free play and snow drifts are formed in every gully and in the lee of every obstruction. Exposed knobs or hill crowns may be practically bare, while in the drifts the snow may be ten times the average depth of snowfall. Thus, a given volume of snow in the forest may have twenty times as much surface exposed to melting influences as if the same volume lay in the open.

[To be continued.]

Power from mercury vapor used in a turbine instead of steam is believed by W. L. R. Emmet to be the means of increasing the capacity of an existing steam station by 66 per cent with a gain of 44 per cent output per pound of coal. Mercury is vaporized at 677 degrees F. in a boiler from which it passes at about atmospheric pressure to the nozzles of a turbine. It then passes to a condensing boiler where its heat is imparted to water whose steam is used to drive other turbines. The condensed mercury liquid then runs back by gravity to the mercury boiler. The purpose is to replace steam boilers and to obtain power from mercury turbines as a by-product. Experiments are being conducted in the laboratories of the General Electric Company, for which Mr. Emmet is consulting engineer.

MAKING STEEL BY ELECTRICITY.

BY ERNST M. SCHMELZ.

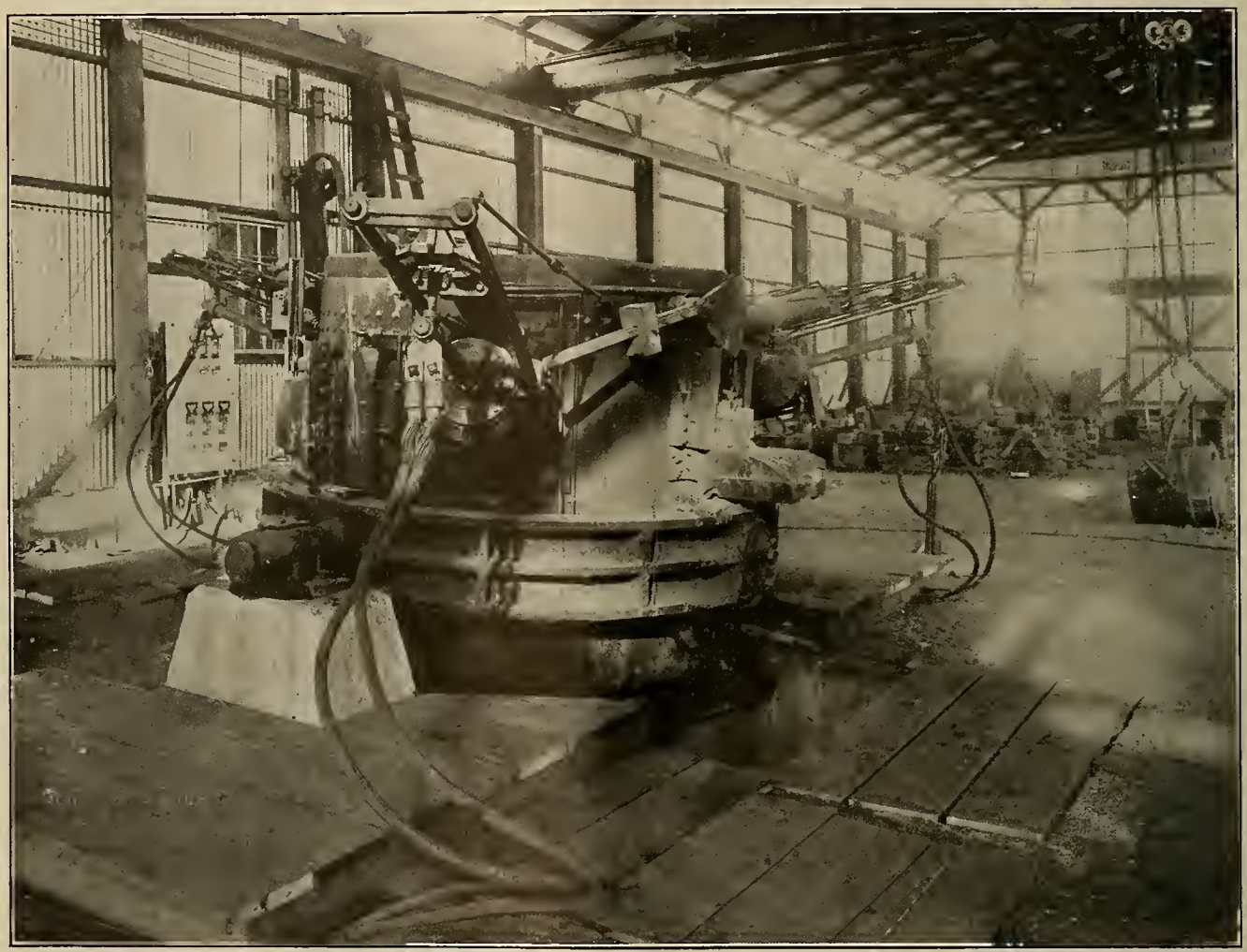
(This subject is discussed from a practical standpoint. The methods of manufacturing steel are touched upon, the types of electrical furnaces described and the Stassano or pure arc system in particular. The metallurgical operations and the operation of the furnace is referred to and installation and operating costs given. The paper was presented before the Los Angeles Section, A. I. E. E., October 23, 1913.—The Editors.)

Assuming that some of you may not be familiar with the methods used for manufacturing steel, I will refer to them in a few words.

Steel is manufactured from pig iron, the product of the blast furnace, by oxidation of the superfluous carbon and silicon in a Bessemer converter, by simply blowing air through the molten bath. The product thus obtained invariably shows gas enclosures, the process is very difficult to handle, and faulty charges, are a frequent occurrence.

Another way is the melting of pig iron and scrap in an open hearth furnace by means of gas produced from oil or coke. If this open hearth furnace is lined with acid brick, it can do no refining, while if a basic lining is used the cost of production is increased, and in any event, the impurities contained in the melting medium—the gas—prevent to a certain extent the refining of the charge.

Up to a few years ago, the only way to produce a high quality of steel was by means of the crucible process. Small quantities—100 to 160 lb. usually—of high grade and very expensive scrap, were melted up in clay and graphite crucibles, heated by oil, coke or gas. While the product of the crucible process can be obtained in very good quality, the method has a number of very great disadvantages. No refining can be done. The raw material has to be of the same high quality as desired in the product. In making a big casting or ingot, the contents of several crucibles have to be poured together, which causes great trouble in timing the pots to be ready at the same minute. The analysis of the steel will differ slightly in each pot, and in addition to all that the cost of fuel and crucibles make this process so expensive that the cost per ton of molten metal varies from $65 to $85, and sometimes even more.



Stassano Electric Arc Furnace at Warman Steel Casting Plant, Los Angeles, Cal.

That is why the steel men the world over are watching with keenest interest the developments of the electric process, which has proved in practice to remedy all these troubles.

Among the hundreds of designs and methods for electric furnaces invented and patented during the past two decades, there are only a very few which have stood the practical test and proved to be of value for the manufacture of steel in a commercial way. We classify them in three groups.

1. **The resistance furnace proper** which produces the temperature necessary for the melting and refining of the steel by the heat developed in the charge itself

when an electric current is forced through it. The current is introduced into the metal either by metallic anodes, as in the case of the furnaces of Gin, or by means of induction, a copper winding in the center of the furnace forming the primary, and the ring-shaped bath itself forming the secondary coil of the transformer. Furnaces of this type have been designed and built by Kjellin, Roechling-Rodenhauser, Frick and a few others.

2. **The combined arc and resistance type,** where the current enters the furnace by a carbon or graphite electrode, forms an arc between the electrode and the bath, flows through the metal and leaves the furnace either by means of another electrode, or through metallic conductors in the bottom. The names of Heroult, Girod, and others are connected with this type.

3. **The pure arc furnace** represented by the Stassano system only, which uses the heat of the electric arc playing between two or more electrodes above the metal without touching the bath.

If I gave a complete description of all these furnaces I fear I would wear out your patience, therefore I will restrict my explanations to the Stassano furnace, which I have been familiar with for the past six years, and which I may say I have helped build up. I will refer to the other systems only if a comparison is necessary to clarify certain points.

More than fifteen years ago, after a long period of laboratory experimentation, Ernesto Stassano, an officer in the Italian army, started to build his first electric furnace. His aim at that time was to produce steel from iron ore, and thereby make his native country, which is rich in ore deposits but unfortunately possesses no coal, independent of foreign steel producers. The first furnace resembled closely an ordinary blast furnace, the tuyeres being replaced by water-cooled carbon electrodes. Stassano did not get very encouraging results with that furnace and changed the design repeatedly before he was able to get the correct form and dimensions for a furnace of the pure arc type, which would answer the practical requirements of the foundry.

The furnace in its present form is equally well adapted for the treatment of ore as for the melting of pig iron or of steel scrap, but the latter process has been worked out to give a complete control of the metal, and has been in practical use for more than nine years, while the ore treatment is still in its infancy.

It may be best here to give a description of the furnace in its present form to facilitate the understanding of its development. The furnace consists of a round or hexagon shaped melting chamber covered by an arched roof and backed by an outer lining of silica or neutral material. Through the side walls of this chamber the carbon electrodes are entered, dropped slightly from the horizontal, and meeting in the center of the melting chamber above the surface of the bath. There are two charging doors and one pouring spout divided equally around the circumference, which provide for the charging of the raw material, the removal of slags, and the pouring of the finished steel. The charging doors are big enough to allow the charging of pieces about 10 in. square, and two feet long. The electrodes enter the furnace through water jackets, and are controlled by means of hydraulic cylinders mounted on the water jackets. By forcing water under pressure between the piston and the front cylinder head the electrodes are pushed into the furnace; by reversed action they are drawn farther apart. These movements change the distance between the ends of the carbon electrodes in the furnace, thereby increasing or decreasing the resistance offered to the arc by the air space, and represent a very effective and simple way of regulating the amperage in the electrodes which stands in direct proportion to the heat developed by the arc. The regulation is effected by hydraulic valves placed on a support near the furnace. The man who operates these valves has one, two or three ammeters, one for each circuit of the furnace. The reading of these ammeters show him if each electrode is drawing its normal amount of current, and directs him to operate the valves in either direction. There would be no difficulty in arranging an automatic device to operate this regulation, but my practice shows that all devices of that sort are complicated, easily get out of order, and tend to make the men inattentive. The regulation needs one man's full attention only when cold metal is brought into the furnace. After the charge is melted the ammeters become so steady that the man can devote most of his time to other duties. The steadiness of the current demand of the Stassano furnace, by which it is distinguished from all other arc furnaces, is caused by the fact that the electric arc in the Stassano furnace is playing between the electrodes only, and does not come in contact with the metal or any other materials of varying resistance.

The melting chamber with all brick material is enclosed in a sheet steel shell, which is suspended from two trunions in a horizontal steel ring. This ring in turn is suspended from another pair of trunions with bearings on supports, the axes of which are at right angles to the first named trunions, thus giving the furnace proper the same suspension as a ship's compass.

To the bottom of the steel shell is attached a short shaft with a ball turned on the lower end. A gear operated by a small electric motor engages the ball and causes it to rotate around an axis perpendicular to the plane on which all four trunions are mounted. The rotating movement of the lower part of the furnace is transformed by the double pair of trunions into a double swinging movement of all the upper parts, and has the effect of thoroughly mixing the liquid metal in the melting chamber during any length of time desired. This not only aids the reaction of the refining slags, but produces a uniform composition throughout the entire charge. This construction greatly simplifies the water and electric connections between the furnace and the main supply. An older design of the furnace accomplished the mixing of the charge by rotating the furnace on an inclined plane, and it was only by complicated and rather expensive devices that the water and electric connections were maintained. Although several of the last mentioned furnaces which I built in Europe have been working for many years without giving reason for complaint, the new design is a marked improvement from the standpoints of simplicity and economy.

Right here is an appropriate time to describe the

metallurgical operations performed in the furnace. Foundry practice demands either the simple melting of a high grade charge, or the melting and refining of inferior raw material to obtain a high grade product. If re-melting alone is your object then the whole operation consists in melting the stock with an addition of lime to bind oxides which enter the bath in the form of rust on scrap with which the furnaces was charged, in removing the slag and in heating the metal up to a proper pouring temperature.

If it is desired to refine a charge, the removal of the impurities—mainly phosphorus and sulphur—is accomplished in the following manner: Immediately after the previous heat has left the furnace, the re-charging of the cold scrap begins, and, in the initial charge, it is usually possible to get two-thirds of the capacity; that is, in a one-ton furnace about 1400 lb. can be put at once into the melting chamber. Together with that, a sufficient amount of iron ore and lime is added to oxidize the carbon, and later on the phosphorus contained in the steel. Gradually, as the charge melts, the remainder of the scrap is added, and in about three hours the melting is completed. The bath is now very hot, and sample of the steel taken shows a highly oxidized state of the metal. The phosphorus slag is now taken off, the bath de-oxidized by the addition of a suitable amount of ferro-manganese and ferro-silicon, and the carbon contents of the steel raised to approximately the desired point. Then calcium carbide and lime are added to form a slag for the removal of sulphur. If necessary, this slag is renewed two or three times to accomplish the desired stage of de-sulphurization. After the last slag is taken off, a sample of the metal is poured in a test mould, and the final de-oxidation is done by the addition of ferro-manganese and ferro-silicon; the exact carbon content to give the steel the specified hardness is obtained by the addition of pig iron.

The metal is now ready to pour, and the furnace is tilted by a simple mechanism, until the metal escapes through the spout. Either the entire charge may be at once emptied into a bull ladle or direct into small hand ladles, as is most convenient. To accomplish still further purification, it is advisable to add about 2 lb. of aluminum in the ladle for each ton of steel. To obtain a thoroughly mixed and homogeneous charge, the rotating mechanism is operated at regular intervals during the refining period.

Now, being acquainted with the furnace and its operation, we can determine the operation cost. Taking the one-ton type as a basis, we have to figure on an investment of $3500. This sum includes the furnace, foundation, water and current connections, and engineering service. We will distribute the cost of one ton of molten steel over the different items, as follows:

Cost per ton of Molten Steel.

1.	Current	$ 9.00
2.	Furnace lining	2.00
3.	Electrodes	.96
4.	Labor	3.50
5.	Raw material	10.20
6.	Alloys	1.00
7.	Depreciation and interest on investment	.38
	Total cost per ton of molten metal.	$27.04

In melting and refining our practice has shown that approximately 900 kw.-hr. represents the current consumption, and the average price throughout the country about one cent per kw.-hr.

For one lining approximately 1000 magnesite bricks are used, and the cost, including labor, is $160. This will produce an average of 80 heats, making the cost per ton for this item $2.

Labor item provides for two men for five hours at 40 cents and 30 cents respectively, a total of $3.50.

On melting stock an allowance of 2 per cent is made for furnace loss, requiring 2040 lb. at $10 per net ton.

Depreciation and interest on investment are each figured at 6 per cent, a combined charge of 12 per cent on $3500, which is $420. The furnace will be in operation for 240 days, omitting Sundays and time required for re-lining, and will produce five tons per day, an annual output of 1200 tons. The distribution of $420 over this tonnage shows a charge under this head of 38 cents per ton.

These costs are based on a continuous 24-hour per day operation. If only three heats per day are taken off, making it necessary to keep the furnace under a partial heat while not in active use, the various items will be proportionately increased to make the cost $32.05 per ton of molten metal.

In the first part of this paper, I have pointed out the advantages electric furnaces in general possess over the old methods of steel making. I will now explain why, among all electric furnace systems in use, I am giving the preference to the Stassano furnace.

From a close study of theory and practice in electric steel, extending over many years, I find that there are certain qualifications an electric furnace must have to come as near perfection as modern science will allow. These qualifications are as follows:

Metallurgical Properties.

1. All metallurgical operations must take place in an atmosphere chemically neutral, so that bath and slag are protected from all outside chemical influences.

2. The transformation of the electric energy into heat must take place at the highest obtainable temperature, so that any desired temperature in the bath or slag can be obtained.

3. A compact area to the surface of the bath, and means to provide easy access to it.

4. If desired it must be possible to let the bath stand for any desired length of time, perfectly quiet under the influence of the heat to give gases and slag enclosures time to rise to the surface. At the same time it must be possible to mix the charge thoroughly in a mechanical way if so desired.

Electrical Properties.

1. Adaptability for every kind of current, voltage and number of cycles.

2. Use of as high a voltage as is consistent with safety for furnace and men, at the same time avoiding all high pressure current on the furnace itself.

3. A simple and safe method of regulation.

Mechanical Arrangements.

1. Efficient tilting arrangement.

2. Simple and strong construction, giving highest guaranty against accidents.

Economical Features.

1. Low cost of installation and up-keep.
2. High factor of efficiency.
3. Adaptability of one type for all purposes.

If we investigate, we find that the Stassano furnace meets the above named conditions. The neutral atmosphere is perfectly obtained. All doors and openings are tightly closed during the operation; the electrodes do not enter the bath, and the lining is neutral. The temperature of the electric arc is the highest of all heating mediums known to science, it being estimated at 6300 degrees Fahrenheit. This heat is equally distributed over the entire surface of the bath, and notwithstanding the enormous heat the burning of



Exterior View of Warman (Electric) Steel Casting Company's Works, Los Angeles.

the metal is impossible on account of the absence of an oxidizing atmosphere. The surface of the bath is square, hexagon or circular. There are no side channels. The large doors make the charging of the furnace and the handling of the slag as easy on a small type of furnace as on a large one. The rotating movement of the bath for mixing purposes can be stopped at any desired moment to allow the metal to rest.

The Stassano furnace is the only one which can be run by direct current as well as any kind of alternating current of any voltage, single, two or three-phase; and the number of cycles is immaterial. The voltage used is from 110 to 150, or on larger types, up to 225. It is never necessary to use high voltage in the furnace. The hydraulic regulation of the current by hand levers is both accurate and dependable.

The tilting mechanism, as previously outlined, is very efficient, and all parts of the furnace are built strongly with a high safety factor. The cost of construction given before show it to be less than required by other systems. The high factor of efficiency of the Stassano furnace is shown by the low energy consumption.

The same type of Stassano furnace, outlined here, can be used alike for melting pig iron or steel scrap, for cold or molten charges, and can even be used for the reduction of ore.

As a special feature of the Stassano furnace, I want to call your attention to its small furnace loss. The Bessemer process shows a loss of from 15 to 20 per cent (difference in weight between the product and of the raw material charged); the open hearth and other electric furnaces show 10 per cent. The Stassano furnace keeps that loss down to 2 per cent or even lower. Not only does this give an increased production of 8 per cent without additional cost or time, but it renders the furnace especially valuable for the manufacture of the chromium, vanadium, nickel and other alloys of steel.

I hope the foregoing will give you an idea of what an important revolution in the steel industry the electric furnace is bound to create, and how well it is able to open up new fields for this industry in places where fuel is expensive and the "white coal," as the French call the hydroelectric power, is cheap.

LETTER TO THE EDITOR.

San Francisco, January 16, 1914.

To the Editor:

The editorial on a "Corporation With a Soul" in your issue of January 10th meets with my full approval.

The "soulless corporation" phrase was the figment of the brain of some irresponsible newspaper man seeking agitation against public utilities. In my judgment, the corporations have vastly more soul than most organizations, including political ones, and largely more than most individuals.

The soul of a corporation is the personal equation of management and is reflected in subordinates. Affability and courtesy and some belief in the rights of others creates the condition of the soulful corporation —the absence of it that of the soulless, if there is such a thing.

I do not believe that regulation has had anything to do with the change in aspect of corporations—merely the necessity for self-protection, which is predominant in corporations as well as individuals. As the business of corporations has increased vastly and has come into contact with more and various kinds of people, it has become unconsciously better and formulated conditions for dealing with them on right principles.

Such an editorial as you have published will certainly be productive of good.

Yours very truly,
(Signed) JOHN A. BRITTON,
Vice-President and General Manager,
Pacific Gas and Electric Company.

The 1913 copper production of the United States according to the estimates of the Geological Survey, was 1,223,700,000 lb. of blister and Lake copper as compared to 1,243,268,720 lb. in 1912. At an average price of 15.3 cents the 1913 output has a value of about $187,200,000, against $205,139,338 for the 1912 output, Preliminary statistics showing the output of refined copper are not collected by the Geological Survey. Figures published by the Copper Producers' Association show an output of 1,483,480,408 lb. for the first eleven months of 1913 and indicate that the production of marketable copper by the regular refining plants from all sources, domestic and foreign, will amount to 1,618,000,000 lb. for 1913 if the December output is equal to the monthly average for the first eleven months. This compares with 1,568,104,478 lb. in 1912.

LIGHTING METHODS

A VINDICATION OF PROPER LIGHTING METHODS

BY A. L. POWELL.

(This comparison which shows the wonderful improvement in den lighting due to the use of proper methods, is abstracted from a paper which Mr. Powell read before the New York Section of the Illuminating Engineering Society on January 8, 1914, on some interesting changes made in the lighting of a private home where an inefficient and inartistic installation was replaced with one in which the essential features are eye-protection, artistic appearance, good diffusion, and economy.—The Editors.)

This is a relatively small room 11 ft. x 10 ft—110 sq. ft. (3.35 m. x 3.05 m.—10.22 sq. m.) used for reading, playing cards, writing, etc. Fig. 1 shows the old lighting equipment a combination gas and electric multi-arm chandelier, which was inadequate, as well as unattractive. Three 50-watt clear carbon lamps with pressed glass shades were in use; the lamps being installed at angles of 45 degrees with the vertical and but 6 ft. 6 in. (1.98 m.) above the floor, they were controlled by key sockets. The glare was extreme; there was practically no diffusion, and the distribution very unsatisfactory, a condition which was particularly noticeable when one played cards on the table located in the center of the room. The direction of light was such as to place the faces of the cards into shadow.



Fig. 1. A Fixture Both Inartistic and Inefficient.

The fixture was replaced by a totally indirect unit (see Fig. 2) consisting of a one-piece mirrored glass reflector in a casing of an Egyptian design which has sand blasted finish and brushed brass high lights. The chain suspension is of such length as to bring the lamp 7 ft. 3 in. (2.21 m.) from the floor. A 100-watt clear tungsten filament lamp is used, controlled by a pull switch in the base of the fixture.

Although the ceiling is white, the walls are of dark green paper with a brown wainscoting, which causes the illumination efficiency to be relatively low. The distribution is good and the general effect pleasing. The intensity is sufficient for the conditions to be met, yet it is not high enough for fine work, such as sketching, etc., and it is planned to install a baseboard receptacle near the desk and use a suitable local lamp at the desk when required. A suitable intensity could be secured with a larger lamp in the center outlet, but from the standpoint of economy the first scheme seems desirable.



Fig. 2. Improved Illumination and More Artistic Appearance, With Greater Efficiency.

Illumination Readings.

Stations.		Actual illumination old equipment.	Illumination old equipment corrected to 3 50-w. 2.97 w. p. c carbon lamps.	New equipment tungsten filament lamp at 1.08 w. p.c.
A	3 ft. (0.91 m.) horizontal	0.60	0.69	0.96
	45° toward light.....	0.96	1.09	1.42
B	3 ft. (0.91 m.) horizontal	0.51	0.58	1.28
	Vertical top bookcase..	0.81	0.92	0.94
B	Vertical bottom bookcase	0.25	0.29	0.30
C	3 ft. (0.91 m.) horizontal.	0.40	0.46	1.09
D	Horizontal desk level..	1.42	1.62	1.73
D	Horizontal desk level shadow test-writer in position	0.73	0.83	1.69
E	Horizontal typewriter level	0.56	0.64	1.19
	45° toward light	1.07	1.22	1.56
F	3 ft. (0.91 m.) horizontal	4.10	4.70	2.30
G	45° plane away from light position of paper in reading	0.91	1.04	0.87

METHOD IN HOME LIGHTING.

(Continued.)

1. The Entrance Gate.

In the West we have built hurriedly, and custom is excluding somewhat the vast possibilities which lie in the proper treatment of the entrance gate. This is especially true where so many suburban homes exist on streets none too brilliantly lighted. As a matter of fact the entrance gate is conspicuous by its absence.

There is no reason against the development of this feature. It is something we have forgotten. Something which could be made distinctive and give character to the dwelling. At the same time it could be made useful if properly lighted.

A wide range of lighting fixtures is therefore possible, from those installed upon brick or stone piers—usually in the form of lanterns or of old style street lamp design, or again, of a style to give a finished appearance to the piers—to the all metal and more simple for the much smaller homes.

This is a possibility though with all and well worth careful development.

Where the residence is sufficiently pretentious the side entrance should be properly lighted and the outside of the stable or garage. A three-way switch should be provided so that the lights may be turned on or off from the front of the house or the outbuilding.

2. Outside Decorative Lighting.

If it is at all possible that outside decorative lighting will be used on special occasions then one or more circuits should be run to convenient points to there terminate in weather-proof boxes containing branch blocks with fuse plugs for protection of the rest of the system. This will save much of the additional wiring expense later as special festoons of lamps can be kept on hand to be merely connected to these branch blocks at any time they may be required.

3. Veranda and Porch.

Adequate veranda and porch lighting is good burglary protection and if for this reason alone, should always be provided.

The choice of units hinges largely on the style of veranda—whether small or extensive; sides open or enclosed; ceiled or with open rafters.

It is important, however, to bear in mind that all outside lighting units, that is, those exposed to the weather, should be of a style that will require minimum cleaning. Not that there is any excuse for neglecting to clean lighting equipment, but it is a weakness of human nature to omit the attention due those things which faithfully perform their duties with a minimum of necessary care.

Neglect in cleaning electric lighting equipment was also excused on account of the fragility and consequent high rate of "infant mortality" of the early types of tungsten filament lamps. There is now, however, no excuse for neglect on this score, for present day tungsten lamps are sufficiently rugged in construction to permit frequent handing. Both from the viewpoint of appearance, efficiency and sanitation, cleaning is essential whether the units are within or without, but in the latter case it is the part of wisdom to install as stated, only those units which will suffer least on these points as a result of weathering the elements. Those which will also withstand the attacks of moths and other winged insects which, although they cannot singe their wings will still flutter about the light until exhausted. Their strivings to get as close as possible to the light leads them to the smallest opening, into which they crawl and die—to the detriment of the appearance of the lighting unit. All of these bad features may be avoided or minimized by careful selection of the fixtures and glassware, a large variety of proper design being available for this purpose.

Utility must not, however, be subordinated to appearance. As with the lighting at the entrance gate so that on the porch is a mark of distinction and of character, but on the other hand the mild weather of the West invites so enticingly to the cool of the veranda during the evening hours that sufficient illumination should be possible from these lighting units to permit card playing, reading, and so forth.

Two systems might be advantageously provided, (1) a decorative fixture giving average illumination for general use, and (2) good general illumination for special occasions.

For ceiling units balls or globes and hemispheres are most popular and practicable, but due to the effect of the weather spoiling the appearance and lowering their efficiency, crystal rough inside (C. R. I.) glassware should not be used. Much prettier effects can be secured by the use of light density opal glassware such as that made under the trade names of Alba and Veluria, and with the outside surface glazed. Such glassware does not deteriorate through exposure to the weather and its additional cost is easily saved on account of the much lower absorption of light and higher illuminating efficiency, which permits the use of lower wattage lamps.

It is perhaps unnecessary to mention that all outside fixtures should be of a material and finish which will withstand the disintegrating effects of the weather.

[To be continued.]

To hold lamps in their sockets where vibrations are likely to shake them out, merely put a rubber band over the threads on the base. The friction is sufficient to keep the lamps in place.

Ductile tungsten for incandescent lamp filaments is made by repeated hot-workings of sintered tungsten powder. The metallic powder is reduced from the purified oxide by gradual and long-continued heating to about 1000 degrees C in a hydrogen atmosphere in a porcelain or quartz tube. The powder is pressed into an ingot, sintered at a white heat by the passage of an electric current and then passed through about forty dies to slowly reduce it from a ¼ in. billet to a ½ millimeter filament. The whole process requires great care and time to convert the metal from a crystalline to a fibrous structure. The final filaments are pliable and ductile at ordinary temperatures, and are exceedingly strong and tough.

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POWER AND GAS

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Letters to the Editor

Every institution may be but the lengthened shadow of a man, but in course of time the shadow of the individual must give place to the substance of collective effort if the institution is to fulfill its highest purpose. This is especially true of the technical journal which is a system colossal, in that it is nation wide—international even—in its scope and service.

Recording progress, the technical journal points to the possibilities which progress contains.

In the electrical field there is nothing so constant as change. While one man says that it cannot be accomplished, another man does that very thing. As one man is describing the "best" way, another evolves a better. Everything is conditional only. Not the best possible, but the best possible at that time.

Bigger, broader and better issues are a natural result of those just fought out.

"The truth is in the air," wrote Emerson, "and the most impressionable brain will announce it first, but all will announce it a few minutes later."

But the most impressionable brain does not always announce or record although it may be the first to discover. Such discoverers have their own thoughts speak to them from the printed page with a certain alienated majesty, for they are clothed in the words of others.

If on reading an article you detect the further progress which that article suggests, it is both your duty and privilege to give expression to the newly generated idea or different viewpoint.

Light is yours that you may bear witness to that light.

Time was when subscribers thought that the payment of a journal subscription merely meant that a certain number of issues paid for in advance had secured to them a substantial reduction. Now they know that it is merely an indication on their part that they wish to participate in journal service. This involves co-operative effort—giving as well as receiving.

Each individual in a collectivity must do his part if the greatest measure of success is to be realized for all.

As a matter of reciprocity and mutual benefit, every reader owes it to every other reader to give expression to his ideas whenever they differ from those generally accepted or from the published information.

If the reader will do his part we may be relied upon to do ours.

This journal is at once a source and a reflector. A unit composed of many master minds. These generate the ideas which are concentrated by this journal and reflected in its pages.

Our reflector has a wide distribution. A vast audience is assured which will listen eagerly to the exposition of your thoughtful purpose.

But unless the new idea, the different way or viewpoint is expressed, and "the most impressionable brains gets action, it is impossible for us to express it. To that extent the source burns under voltage.

Because this journal is a reflector we are prepared at all times to project from its pages ideas which are different, both sides of a question, and the possible better way.

In the January 10th issue was published the Forestry Department's view of a certain question, the other side of which had previously appeared in our pages.

Last week we published a letter to the editor sent by an Eastern engineer who congratulated us upon a new department of Journal service recently inaugurated.

In this issue is published a letter from an official of a large corporation in which he amplifies one of our recent editorials and so gives other readers a still more comprehensive idea of the subject of the soul of a corporation.

It is but natural that all letters received cannot be published, but it is our desire to publish all those which will tend to add to the sum of human knowledge, and once in a awhile those also which express the responsive, "Well done!"

Our columns are open for the use of our readers.

Lighting and the Eye

Those creatures which venture abroad principally at night have eyes different in some respects from those of humans which are more used to daylight conditions. This is due to environment; the adjustment of the instrument to the condition met. It is impossible to conceive of a time when mankind did not perform during daylight those functions which depend upon the use of sight, for the nightfall brought a darkness which it seemed futile to attempt to dispel. A darkness which to an unenlightened mentality, was tangible enough to be felt.

The eyes, never put to a really great strain, enjoyed periods of rest at least equal to the hours of use. Conditions are now vastly different.

At a comparatively recent date the illumination of floors in the aisles of picture theatres running a continuous performance, made an additional innovation in lighting methods. The object was to permit people to find or leave their seats without the necessity of turning on any general lighting. It was a system short lived although these transparent floors were illuminated to a very low intensity, and green light chosen as a color calculated to be restful, notwithstanding also the contrast of the greater intensity of illumination reflected from the picture screen. The result was confusing.

There was the same effect on the eye, although differing in degree, as is produced on a bright day when even squinting, the utmost method of naturally protecting the eye, fails to adequately minimize the eye-strain. Sunlight reflected from snow is even worse and colored glasses often fail to effect the needed protection.

Yet the same intensity of light coming from above the horizontal, causes little or no trouble. The difficulty in the other cases mentioned is that the light comes from below—a condition which the eye has not been called upon to habitually meet and to which it cannot be adjusted. Nature's requirements urge conformation.

The ease with which darkness is now eliminated, thus extending the hours of use and equally reducing the periods of rest, the closer and more constant work which has to be performed, and the careless and inconsiderate installation of inadequate lighting systems, are placing an increasing burden upon our organs of sight.

The increasing number of those wearing glasses is not the result of wider knowledge ameliorating untoward conditions which have always existed though not known, but is evidence of the abuse of this most valuable of the nation's resources—the people's vision.

That the eye will adjust itself over a wide range of intensities of illumination is uncontested, but grave dangers are consequent upon persistent or radical departures from those conditions to which the eyes have become habituated over a long period of time.

Great latitude in planning lighting installations is not allowable. They must not differ very much in principle, from actual daylight conditions.

Such lighting must be steady, of proper quality, sufficient in quantity, come in a downward oblique direction, and be well diffused.

The conservation of vision will be emphasized throughout the articles appearing in our pages devoted to Lighting Methods and the co-operation of all readers to this end, is urged.

Averages Increased Electrically

Only those who have checked the agricultural returns for a whole state or territory know how the averages are lowered through poor yields. The average results in no way indicate the possibilities of the soil. They are rather an adverse comment.

These low yields are in large measure due to incompetency. The city-bred youth, reading of the remarkable returns garnered from the soil resolves that he, too, will do likewise. To plow and sow, reap and gather the harvest. His disappointment occurs when he finds that the ground will not laugh a harvest in response to the tickle of his easy effort. Probably his experienced neighbor reaps sixty bushels to the acre while he reaps but five.

Knowledge of advanced farming methods—the science and art of agriculture—is essential to success, a success in which all the people are intensely interested for it is the foundation of the measure of every nation's prosperity.

Improved methods have resulted in increased crops. Care must be taken, however, that the ground is not impoverished and there must always be returned to it, the elements essential to plant growth.

The power of electricity in fixing nitrogen is contributing to this end.

But the network of power wires which stretch out and across our Western agricultural districts may yet offer to the farmer an easier method of accomplishing the desired end of inducing from the soil its utmost wealth. A further possible central station service looms large on the horizon.

In this issue is published the results of some remarkable advantageous effects produced upon plant growth through electric stimulation.

While there is much of experimentation to be yet-made along this line, investigations should be stimulated by those most interested, for reduced to an exact science this service which would be welcomed by the farmer, should contribute largely to the national wealth.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

F. N. Averill of the Fobes Supply Company, Portland, Oregon, is at San Francisco.

H. C. Thurston, electrical contractor of Ukiah, Cal., was at San Francisco last week.

Andrew Carrigan, of Dunham, Carrigan & Hayden, has left for Chicago and will visit other Eastern cities.

H. V. Carter, president Pacific States Electric Company, spent the past week in Southern California on business.

J. L. Stannard, consulting engineer, Portland, Oregon, announces the removal of his offices to room 614 Lewis Bldg.

Romaine W. Myers, consulting engineer, Oakland, Cal., has been elected a member of the Illuminating Engineering Society.

A. D. Hotson, senior member of the firm of Hotson & Gillies, Vancouver, B. C., has been elected a member of the A. I. E. E.

Roy W. Gray, division plant superintendent of the Western Union Telegraph Company has returned to San Francisco from Los Angeles.

Glenn B. Walker, commercial engineer of the Utah Light & Railway Company, has returned from a three weeks' visit to his home in Michigan

F. N. Cooley, Western Electric Company, left San Francisco last week for Washington, where he will occupy a position with the Seattle branch of the company.

C. F. Conn, engineer with J. G. White & Company at San Francisco has been transferred to the grade of member in the American Institute of Electrical Engineers.

Marshall Tiebout Gleason, of the Gleason Tiebout Glass Company, New York, is at Salt Lake City and will visit the principal cities on the coast before returning East.

E. S. Berdine, western representative Gleason Tiebout Glass Company, manufacturers illuminating glassware, has left San Francisco for a business trip throughout his territory.

S. P. Russell, manager electrical department H. W. Johns-Manville Company, San Francisco, will, with **J. W. Thompson,** illuminating engineer leave for New York on a business trip during the latter part of next week.

Charles L. Edgar, president Boston Edison Company, Boston, Mass., was guest of honor at a luncheon given at the Bohemian Club by **John A. Britton,** vice-president and general manager Pacific Gas & Electric Company.

Hal Lauritzen, manager western division, Holophane Works of General Electric Company, has returned to San Francisco, but will leave almost immediately on a special business trip through the Pacific Northwest.

A. J. Myers, Pacific Coast Manager, Wagner Electric & Manufacturing Company, is at Los Angeles and will leave Saturday (24th) for the East, where he will visit the Wagner factory at St. Louis. He expects to be gone a month.

Geo. C. Moore, who, with English associates, is to finance the properties and assume control of the various subsidiary companies of the United Properties Corporation, has left San Francisco for New York and London, to complete the arrangements.

C. R. Hummerick, previously with Fobes Supply Company, Portland, Ore., and **W. H. Merrill,** who has been with the Lewis Electric Company, Boston, Mass., for the past nine years, have joined the sales force of the Electric Appliance Company, San Francisco.

Robert H. Parker, local manager of the Butte office of the General Electric Company. stopped over in Salt Lake City last Saturday, on his way to Chicago. He reports the prospect for business in Montana during 1914 as being brighter than during several years past.

C. P. Lindsley, the Lindsley Brothers Company, **W. M. Leavitt,** National Pole Company, and **M. P. Flannery,** B. J. Carney & Company, Spokane, Wash., were appointed members of the Pole committee of the Western Red Cedar Association, the first named being chairman.

H. W. Fielding, superintendent of construction, Western Canada Power Company, Ltd., Ruskin, B. C., and **E. R. Perry,** draftsman, Puget Sound Traction Light & Power Company, residence Waldorf Hotel, 7th and Pike streets, Seattle, Wash., have been elected associate members, A. I. E. E.

Ellis G. Brode, formerly in the Boston office of the General Motor Company, has accepted a position with the Capital Electric Company as electric vehicle specialist. They intend to go actively after the vehicle business in this territory, as the considerable amount of street paving recently completed and in progress renders the use of motor vehicles in Salt Lake more feasible than heretofore.

MEETING NOTICES.

Oregon Electrical Contractors' Association.

The Oregon Electrical Contractors' Association had its regular meeting at 6:30 p. m., January 14th, at the Portland Commercial Club. The "new price book" was distributed to the members at this meeting.

The Utah Society of Engineers.

The regular meeting of the Utah Society of Engineers was held on Friday, January 16th, in the Consolidated Music Hall, 15 East 1st South, the new quarters of the society. J. B. Scholefield, public accountant, read a paper on engineering and accounting, with special reference to public utilities, and A. M. Nelson, assistant engineer of the Oregon Short Line, gave an address on the subject, "The Physical Valuation of Railroads." An interesting discussion followed the presentation of these papers.

Portland Sections A. I. E. E. and N. E. L. A.

It is proposed to hold an informal dancing party on the evening of January 27th, at the Multnomah Hotel, under the auspices of the Portland Sections of the National Electric Light Association and American Institute of Electrical Engineers. Invitations will be sent those signifying their intention to attend the dance. There will be no charge for admission. Those desiring to attend are requested to notify R. F. Monges, secretary, care General Electric Company, Electric Building, Portland, Oregon.

San Francisco Electrical Development & Jovian League.

The regular meeting was held last Tuesday at Tait's Cafe. The League as a body endorsed the action of the executive committee in directing the attention of the civil service commission to the necessity and justice of continuing the present appointee in the position of chief electrical inspector instead of automatically removing him by insisting that this position be a civil service appointment. Encouraging progress was reported.

A paper was presented by H. E. Grant on "Why different lighting systems," in which the history of electric lighting was briefly outlined and the various fundamental systems defined and described, also the proper use and limitations of each system. There was a good attendance.

The Utah Electric Club.

At the regular luncheon of the Utah Electric Club at the Commercial Club Thursday, January 15th, the first order of business was the installation of officers for the ensuing year. President W. W. Torrence briefly outlined the proposed activities for 1914 and announced the appointment of the regular standing committees. These committees and their chairmen are as follows: Commercial Organization, Lafayette

Hanchett, National Copper Bank; Membership, J. P. Sprunt, Westinghouse Electric & Manufacturing Company; Social and Entertainment, L. E. Brown, Westinghouse Electric & Manufacturing Company; Athletic, W. A. Moser, Westinghouse Electric & Manufacturing Company; Employment, H. T. Plumb, General Electric Company; "Round-Up," H. J. Brown, Mountain States Telephone & Telegraph Company.

Electric Show Association of Utah.

The annual meeting of the Electric Show Association of Utah was held at the Commercial Club on Thursday, January 15th.

This association was incorporated four years ago by the electrical interests of Salt Lake City and the state of Utah for the purpose of conducting electrical expositions at such times as the general conditions of business warrant. The first show, held in October of 1910, was a complete success from every standpoint.

At the annual meeting Thursday the following officers were elected: Bayard W. Mendenhall, president; C. B. Hawley, vice-president; W. W. Torrence, secretary; J. C. Gleeson, treasurer.

It was decided to hold an electric show in April of this year, and the meeting was adjourned until next Thursday, when the committees to handle the show will be appointed and active work started.

Western Red Cedar Association.

At the regular annual meeting of this association held at Spokane, Wash., Monday, January 12, 1914, President Culver in presenting his annual address, remarked, "We should also use our utmost efforts to have the National Electric Light Association adopt our specifications for cedar poles. Large quantities of poles are purchased annually under specifications suggested by that association and the advantages, therefore, of the desired action are obvious."

After a short discussion the committee on the Forest Products Exposition was instructed to take up with the National Electric Light Association the matter of having specifications for western red cedar poles adopted by that association. At the present time the National Electric Light Association have specifications covering yellow pine poles, Eastern white cedar and chestnut poles, but have none covering the western red cedar. It is the belief of the association that the western red cedar poles are far superior to any of the other three now covered by the specifications of the National Electric Light Association, and it is therefore hoped that during the year 1914 specifications will be adopted by the National Electric Light Association for the western poles.

The meeting was adjourned subject to call of the president. During the noon hour the association adjourned to Davenport's restaurant where an informal luncheon was held in the east room.

ELECTRICAL CONSTRUCTION ACT.

The Washington public service commission has appointed a committee of sixteen to draft amendments to the electrical construction act. The commission is of the opinion that there should be more standardized requirements applying to all companies. As soon as this committee reports, the hearing on the subject which was started on November 5 at Seattle Chamber of Commerce assembly room, will be resumed. The members selected are E. L. Ritter, representing telegraph companies; N. C. Nelson, municipal plants; N. W. Brockett, large power and light companies; J. S. McGee, small power and light companies; W. T. Teague, large telephone companies; John Wilson, small telephone companies; R. K. Reed, signal service; H. E. Durant, H. H. Emerson, R. Nesbit and M. Blair, the unions; George Quinn, electric railways; E. A. Kippel, steam railroads; A. E. Boyles, electrical expert for the commission; J. F. Reardan, inspector of tracks and safety appliances, and M. Vetter, his assistant.

SPECIAL TRAINS TO INTERNATIONAL ELECTRICAL CONGRESS, SAN FRANCISCO, 1915.

Plans are already well under way for special trains from the East in connection with the International Electrical Congress to be held at San Francisco in September, 1915. The trains will represent the last word in safety and comfort, and their itineraries will be laid out to include the finest scenery in the country.

The tentative program, which at a later date will be submitted in detail to the engineers of the United States and other countries for an expression of their individual preferences, includes a round trip of about 30 days' duration with stops in Chicago, Colorado Springs, Salt Lake City, San Francisco, Santa Barbara and Los Angeles. At each one of these places, special arrangements will be made by local committees for the comfort and entertainment of the members of the party.

Other features of the trip will be the Royal Gorge, the Feather River Canyon, and a four-day visit to the Yellowstone National Park on the way out, with a 24-hour stop at the Grand Canyon on the way home.

Should the demand justify it, a special train will also be provided from Chicago straight through to San Francisco to take care of those with whom time is a prime consideration.

The transportation committee of the congress is further considering the possibilities of marine transportation by way of the Panama Canal. There appears to be a considerable demand for this, especially if satisfactory arrangements can be made for combining the land and water features.

NEWS OF THE PUBLIC UTILITIES COMMISSION OF IDAHO.

The Swann Creek Electric Company was granted a certificate of public convenience and necessity to construct a transmission line from the Utah-Idaho state line northerly to Fish Haven and to serve that village, but was refused an extension through to St. Charles on the ground that the Utah Power & Light Company is already serving that village, the business from which does not justify a duplicate system.

J. D. Browning of Pocatello, Idaho, was granted a certificate that the present and future public convenience and necessity requires the construction of an electric street railroad within the city limits of Pocatello, Bannock county, Idaho, for passenger, freight, express and mail traffic.

The Great Shoshone & Twin Falls Water Power Company was ordered to at once cease its practice of withholding the collection of its accounts in the towns of Gooding, Glenns Ferry and Mountain Home for electrical service rendered, as this had been construed by consumers in other villages and cities served by this company as a discrimination against them. The commission ordered an investigation of all rates charged by the company and also by the Beaver River Power Company and the Idaho Power & Light Company hearing being fixed for the 26th of January, 1914.

TRADE NOTES.

The Central Electric Company has been awarded the contract for the installation of electric lights on H street, between State and Sixteenth, San Diego, and the Barth Foundry & Machine Company has been awarded the contract for furnishing iron posts.

The city council of Santa Monica has awarded the contract for the installation of a lighting system in Fremont avenue from Ocean avenue to Eighth street, Santa Monica, Cal., to Woodhill & Hulse Electric Company for $4775 for a lighting system complete.

Owing to rapidly developing business the Olston Electris Stove Company, Los Angeles, will shortly move into a new factory at Twelfth and Central avenue. The new place covers an area 100x125 ft. and will contain all modern facilities for the manufacture of electric stoves.

NEW CATALOGUES.

(Under this heading attention is directed to catalogues and bulletins representing the latest information upon the subjects treated. The latest developments are always in advance of the most up-to-date text books. Readers are urged to write direct to the publishers for these catalogues and bulletins, which, unless otherwise stated, are available for free distribution.)

The General Electric Company recently issued Bulletin A4176, describing its High Voltage Oil Break Switch, known as Type F, Form K-15. This switch may be operated by several methods described in the bulletin, which supersedes the previous one on this subject.

Bulletin A4167 is devoted to the subject of Electricity in Iron Foundries. It is profusely illustrated with typical applications of G-E motors in iron foundries, and contains a chapter on Foundry Lighting. For those looking for information on this subject, the bulletin should be of great interest.

Motor-Driven Exhaust Fan Outfits is the subject of Bulletin No. A4174, published by the General Electric Company, and devoted to the subject of fans for ventilating purposes. It contains, in addition to other data, illustrations and dimension diagrams of the various motors built by the company for this purpose.

The General Electric Company has just issued Bulletin No. A4178, describing their Three-Phase Induction Motor Panels for controlling induction motors of voltages of from 110 to 2200, 25 to 60 cycle circuits. The panels are not intended to be assembled as part of a switchboard. The bulletin contains a long list of standard panels, among which can be found panels suited to practically all conditions of service of this kind.

In Bulletin A4151, recently issued by the General Electric Company, are described that company's Engine-Driven Continuous Current Generators of the commutating Pole Type. These are manufactured in both two-wire and three-wire styles, either shunt or compound wound, 115 to 125, or 230 to 250 volts. They range in capacity from 25 to 400 kw., inclusive. Data on larger sizes, wound for 250 volts only, will be furnished on application.

Baldwin-Westinghouse Electric Mine Locomotives is the title of a pamphlet which has just been issued by the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa., and the Baldwin Locomotive Works, at Philadelphia. The pamphlet describes the new barsteel frame locomotive and its advantages. The various accessories, such as controllers, circuit breakers, trolleys and gathering reels and described and illustrated. Specification blanks for mine haulage locomotives are included.

"Motor Driven Refrigerating and Ice-Making Machinery" (Section 3133) issued by the Westinghouse Electric & Manufacturing Company describes the process employed in this class of work and illustrates the application of electric motors thereto. A number of installations are shown and a curve is given from which the horsepower required for different tons-capacity machines can be determined. There is also included a table showing the type, capacity, and speed of motors required for the different machines in a refrigerating plant together with the kilowatt hours consumption. These tables are compiled for several different plants.

The Crocker-Wheeler Company has issued a Bulletin (No. 160) on "Induction Motors for General Use" that in illustrations and character of text departs widely from the usual publications of its kind. Half-tone illustrations are entirely excluded, all cuts being in line, thereby bringing out sharply the various details to which attention is directed. Instead of reading matter which endeavors to satisfy at once the average reader and the technical man, the first part of the Bulletin is addressed to the former, while some pages at the end are devoted to technical remarks that appeal more particularly to the electrical engineer. By judicious condensation an unusual amount of information is comprised in the 19 pages of the Bulletin; yet the text is so clearly worded that reading requires no effort, and the understanding of the illustrations is facilitated by full descriptive captions. In illustrations, in development of subject and in the use of clear-cut language the Bulletin is a great advance.

The Westinghouse Electric and Manufacturing Company has just issued a number of pamphlets covering railway line material. Catalogue Section DS840 covers Suspensions, Ears and Splicers. Different types of trolley suspensions are illustrated and described; also various accessories, such as expansion bolts, insulators, clinch ears, trolley splicers, strain ears, wire chucks, etc., are listed and illustrated in a convenient manner. Section DS841 covers frogs, crossings, section insulators, switches and lightning arresters. The Detroit trolley frog and other types are fully described and illustrated; also different types of trolley crossings, both rigid and adjustable. In the lightning arrester section, pole type lightning arresters, together with fittings, such as ground plate, ground point and cap, grounding bonds, etc., are described, together with the proper method of making ground. Section DS844 covers strain insulators of various types and for different kinds of service. Section DS850 covers rail bonds and bonding tools. This gives in some detail the methods of manufacture of rail bonds, and also some carefully prepared information on their selection. Tables are given of the net weight in pounds per hundred bonds, and installation views of different types are shown. Rail bonding tools, such as ratchet drills, facing tools, bonding punch, bond compressor, etc., are described and illustrated, and there is also an illustrated description of the portable grinders, torches and clamps.

BOOK REVIEWS.

Handbook of Electrical Methods, compiled from the Electrical World. 285 pages; 5½x9; cloth bound. Published by McGraw-Hill Book Co., New York, and for sale by Technical Book Shop, San Francisco.' Price, $3.00.

This is a valuable compilation of practical kinks in electric construction work. The text is divided into ten chapters treating of underground work, overhead construction, meters, switchboards, circuits, switches, transformers, interior wiring and motors. Each chapter gives a large number of methods of accomplishing work met in actual practice. These are arranged from articles published in the Electrical World during the past three years and is a veritable mine of suggestions for the installer and operator.

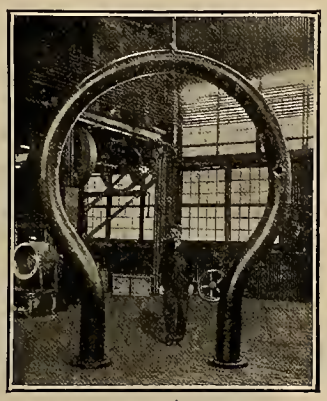
Electric Arc Phenomena. By Ewald Basch; translated from the German by K. Tornberg, General Electric Company; 194 pp.; 6x8½ in.; cloth bound. Published by D. Van Nostrand Company and for sale by Technical Book Shop, Rialto Building, San Francisco. Price $2.

This book discusses the subject thoroughly. The author considers that it is of paramount importance to separate the essential from the non-essential facts regarding electric arc phenomena and to assist the student as well as the practicing engineer in those mental operations and elements of knowledge which involve fundamental principles, the mastering of which is indispensable for an understanding of the present state of the art as well as for the stimulation of independent practical work of a progressive kind. To this end there are chapters on Electric Arc Phenomena; The Typical Carbon Arc; Electrode Materials and Their Physical Properties; The Theory of Electrical Discharges Through Gases; Spark Discharges; Voltage, Current Conditions; Distribution of Energy in the Arc; and Efficiency of Commercicial Types.

INDUSTRIAL

EXCEPTIONAL EXPANSION BEND.

The accompanying illustration shows a 10 in. expansion bend containing 30 ft. of full weight pipe, with Pittsburg flanged joint, recently installed in Bakersfield No. 3 Station



Expansion Bend Containing 30 ft. Pipe.

of the San Joaquin Light & Power Corporation. It will be noted that there is no joint at the top. This rather remarkable equipment was supplied by the Pittsburg Piping & Equipment Company.

EXHIBIT OF WIRING DEVICES.

The illustration below is a reproduction of the Sample Cabinet recently installed by the Bryant Electric Company in their offices at 149 New Montgomery street, San Francisco. This cabinet contains a complete line of the latest wiring devices to be put on the market, including all types of sockets, switches, cutouts, fuses, rosettes, heating control devices, etc. A thorough inspection of this exhibit will convince one that the highest standard of quality, workmanship and convenience has been reached by the Bryant Company in the manufacture of their product. A cordial invitation is extended to all jobbers, architects, contractors, fixture manufacturers, in fact to all who may be interested in electrical wiring devices, to inspect this interesting exhibit.

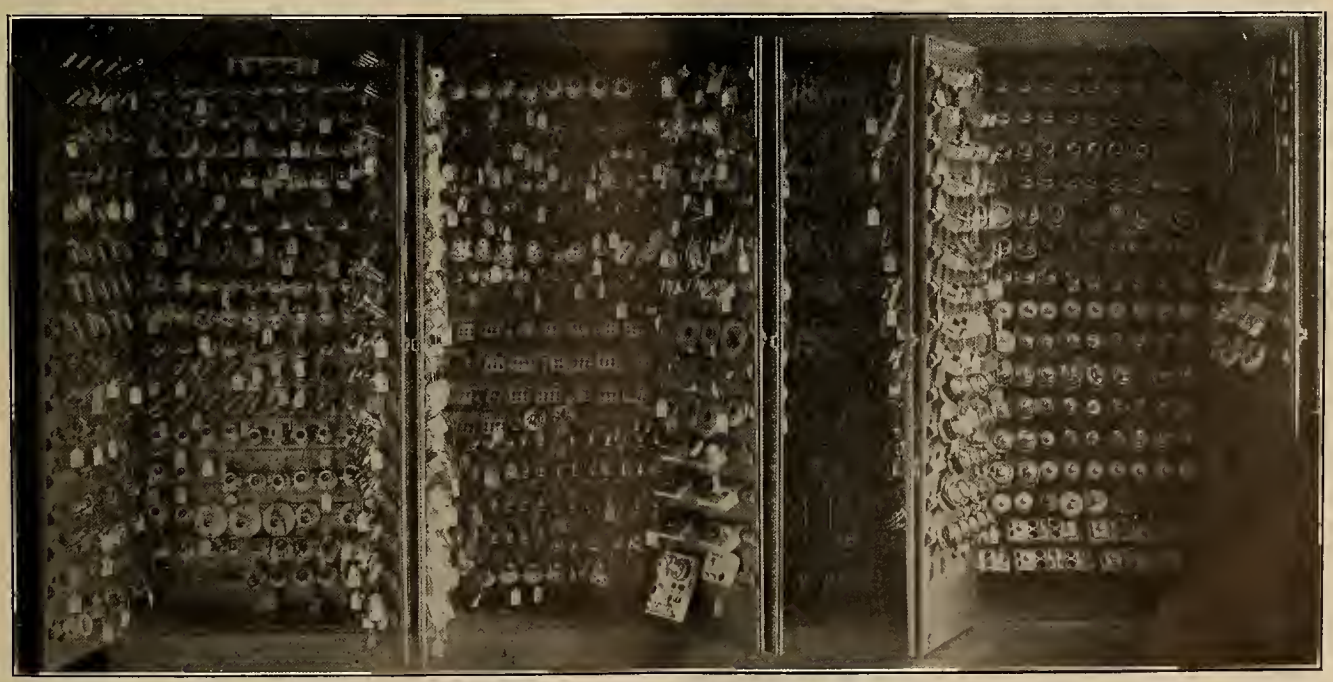
TELEPHONE REPEATING COILS.

Ever since the first idea of electrical communication over wires, either by dot and dash or direct conversation, was put into practice, heroic efforts have been made by the inventive minds to perfect as far as possible, all phases of electrical apparatus. The result is that evolution has played its part to a point almost beyond belief, and obstacles thought unsurmountable have been gradually overcome.

Telegraphing, when finally adopted as a method of communicating over distances, short and long, was found to be simple to a degree, compared with the wonder of it but, early in its commercial success, the telegraph companies were faced by the necessity of adopting some method of construction by which a single wire could be utilized for the transmission of a number of messages simultaneously. Undaunted however, the scientific and inventive brain of the day took issue with the problem, fully realizing that the extremely high cost of long lines for single messages would, in consequence, compel a correspondingly high rate for transmission, thus placing telegraphic communication so far within the pale of luxury that it could not be utilized nor considered by the masses. It is volume which spells success to every business and as the telegraph companies must likewise depend upon volume, every encouragement was given the inventor with the result that the duplex and quadruplex systems, used today in telegraph operation are the crowning achievement of those scientific delvers.

Telephony, with its maze of apparatus, at once secured a firm foothold in the world commercial and social, becoming the right hand of the business man in his office and a servant in his home—a boon, in fact, upon which he became wholly dependent. For long, his country cousin was denied all this, but now, we find the vast stretches of our farming country punctuated at nearly all necessary points by telephone companies in a large measure prepared for first class local service with constant demand for more extended service. The majority of these companies are confronted by the necessity of providing longer lines.

The construction of long toll lines, has, in the past, been more or less prohibitory owing to the necessary outlay,



Bryant Electric Company's Sample Cabinet.

coupled with the fact that all available capital was required to construct the shorter local lines between the several exchanges as they were established and the outcome of this growth is an extensive system of pole lines carrying numerous short local circuits. Thus, the necessity frequently arises of building up a circuit through a half dozen switchboards in order to reach points a short distance away, by comparison, resulting in poor transmission, annoying interruptions from operators coming in on the line for supervision and, withal, slow service.

Telephone companies that owe their inception to a local desire or demand for neighborhood communication, now find themselves obliged to cope with an ever-growing demand for good commercial service between constantly increasing distant points of their systems, which means that they must equip their lines with a system whereby more than one message may be transmitted over a single line at the same time or be prepared to shoulder the great expense necessary in the construction of long toll trunks.

As a matter of fact, the same problem which confronted the telegraph companies, faces the Independent telephone companies today, but fortunately for them, the manufacturer, abreast of the moment, is prepared to assist them at a comparatively nominal cost, and at once obviating the large expense of extensive re-construction and making for the desired betterment of service.

It is hardly necessary to say that the telephone manufacturer realized early in the day, the coming necessity of a multiplex system which would permit the successful working of telephone circuits. Innumerable attempts to solve the problems were made, but with indifferent success accompanied with many absolute failures until the nut was cracked by the development of a repeating coil affording high efficiency and perfect electrical balance together with the elimination of cross talk between the several lines by a systematic arrangement of transposition of the engaged physical circuits.

Fully alive to these conditions the Kellogg Switchboard & Supply Company offers various types of repeating coils designed especially to meet the requirements of every class of telephone service. In magnetic switchboards in which two clearing-out drops are used in the cord circuits, repeating coils, whenever used, must be constructed so as to prevent ringing current from passing inductively from one winding to another, while the high frequency voice currents must pass with only slight loss. These requirements are fully met by their No. 8-A repeating coil shown in Fig. 1.

For another class of service, a repeating coil which will allow both voice currents and ringing currents to pass, is required. Such a repeating coil is used in cord circuits of magneto switchboards, having single clearing-out drops, as well as in phantom telephone circuits, and under similar conditions. For this purpose, they manufacture three different styles of repeating coils, the No. 9-A, shown in Fig. 2, the No. 13-A, in Fig. 3, and No. 14-A, in Fig. 4.

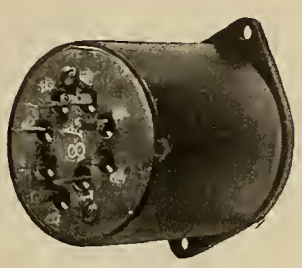


Fig. 1.



Fig. 2.



Fig. 4.

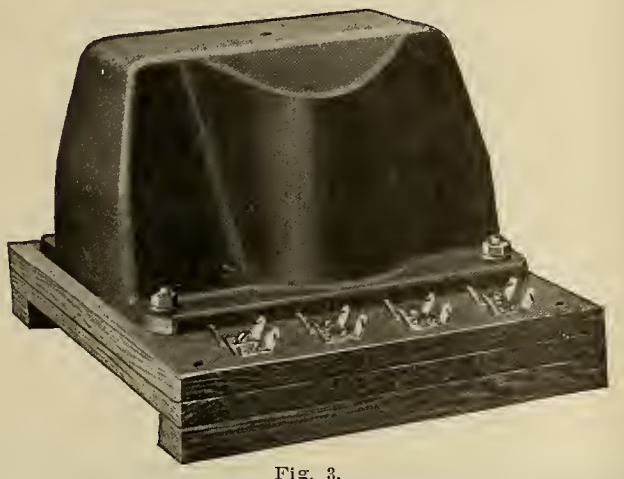


Fig. 3.

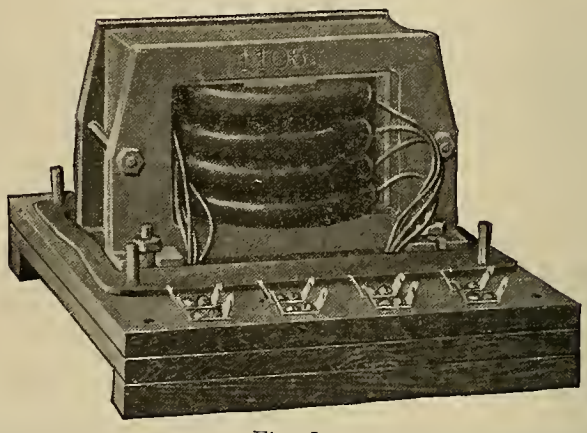


Fig. 5.

No. 9-A, which is less expensive than the other two, is suitable for use in connection with short lines of low resistance. The No. 13-A was designed especially for phantom and long distance work, and is said to be the most efficient ring-through and talk-through coil which has ever been developed. It is enclosed in an iron case, which excludes moisture and prevents cross talk. It consists of four windings each of which is wound separately so that if one is burnt out by lightning, or high tension current, it can he replaced at small expense, thus making it unnecessary to throw away the entire coil.

The No. 14-A repeating coil is the same as the No. 13-A, aside from the fact that the iron shell is omitted and, as a result, it must be mounted inside of a building where it is not exposed to the elements.

The Kellogg Company has recently placed upon the market their No. 15-A repeating coil, illustrated in Fig. 5. This is primarily a talk-through coil but so compact that it can be mounted in a very small space. No. 15-A represents their very latest development in repeating coil construction. It was especially designed for long distance work, or for any condition in which a high efficiency talk-through coil is desired.

NEWS NOTES

INCORPORATIONS.

LONG BEACH, CAL.—Towne-Lantz Electric Company; $15,000, subscribed $12,000, by A. A. Towne, F. O. Lantz et al.

ILLUMINATION.

SUMAS, WASH.—Plans for rebuilding the lines of the Sumas Electric Company in this city have been submitted to the public service commission.

EUGENE, ORE.—The council has passed an ordinance for the establishment of ornamental street lighting on Olive street, at an estimated cost of $1920.

SAN RAFAEL, CAL.—The city attorney was directed to prepare resolution of intention for installinf electroliers and prepare resolution of intention for installing electroliers and

LOS ANGELES, CAL.—Sealed bids will be received up to February 2d by the board of supervisors of Los Angeles county for installing and maintaining a system of street lighting in Ivywild lighting district.

HUNTINGTON BEACH, CAL.—The city trustees have granted the Pacific Light & Power Company a 40-year franchice for supplying light and power to Huntington Beach, the present supplying company, the Huntington Beach Company, turning over poles and wires to the Pacific Company.

HUGHSON, CAL.—At the last meeting of the board of trade the matter of street lighting was taken up, and a committee consisting of Miles Shelly, E. F. Sawdey, and C. P. Richardson was appointed to prepare a plan with the idea of lighting the entire town in a creditable manner.

SEAL BEACH, CAL.—Application has been filed for laying of gas mains throughout the town of Seal Beach, and it is expected that immediate action will be taken. The main lines are already to Almitos, and soon as the application is granted work will begin on the extension to this resort.

CALEXICO, CAL.—The city trustees are figuring upon the possibility of Calexico operating its own electric light plant. The city engineer has been instructed to estimate the cost of installing and operating a plant in conjunction with water works which will be capable of furnishing lights for the streets.

CONCORD, CAL.—The town trustees have awarded to S. Waldo Coleman a franchise to serve this city with gas for the next fifty years. Coleman, who is organizing the Contra Costa Gas, Light & Heat Company, was the only bidder for the franchise and will at once build a gas plant and service mains to supply Martinez, Concord, Pittsburg and Antioch.

OGDEN, UTAH.—The General Service Corporation, represented by J. H. Bacon, has petitioned the Ogden City Commission to extend the time limit of the franchise granted to C. A. Boyd from February 14, 1914, to January 1, 1915. The communication states that a deal is pending whereby this corporation is to purchase the Ogden gas plant of the Utah Light & Railway Company. Officials of the latter company, however, deny that any such sale is under consideration.

SALT LAKE CITY, UTAH.—The board of education has decided to enter into a contract with the Utah Light & Railway Company for the purchase of electricity for supplying the new East Side High School. They have abandoned their original intention to install a generating plant for the purpose of supplying electric service, a careful investigation having demonstrated the fact that central station service is cheaper. The domestic science department of the high school will be equipped with electric hot plates, and all cooking in the cafeteria will be done by electricity.

TRANSMISSION.

EDMONTON, ALTA.—The estimated expenditure for the year 1914 in the city of Edmonton includes $500,000 on extensions to the electric power plant. A new power house will probably be built and one or more units installed.

KLAMATH FALLS, ORE.—Engineer McLane has been instructed to place a physical valuation on the Ankeny ditch, the power site at the head of the ditch and 5000 miners' inches of water. This is another step toward municipal power and light.

CLIFTON, ARIZ.—The Detroit Copper Mining Company has begun work on an electric line leading from Morenci to the company's mining properties in the vicinity of Metcalf, known as New England group. Power will be used for extraction of ores at the company's property.

STOCKTON, CAL.—A contract has been closed by the Western States Gas & Electric Company with the California Exploration Company covering 1075 h.p. At the present time this concern is using 240 h.p. served by the Western States Company and the new load will be taken on about June 1st

BREMERTON, WASH.—The council passed an ordinance authorizing the promoters represented by Gustavus F. Rust, to build a power plant on Hamma Hamma River near Elder in Mason county, and to transmit the power to Bremerton, and build a street railway system. An election will be held April 14 to ratify the measure.

HOOD RIVER, ORE.—With 40 members present the Odell Development League met and by unanimous vote took action toward the construction of a co-operative light and power plant on the Hood River near the vicinity. A thorough investigation will be made by a committee composed of Mark Cameron, Geo. Sheppard, Harry Connoway, R. E. Miller and J. E. Ferguson, to secure the sentiment as to stock subscriptions and to secure the services of a hydraulic engineer, who will make estimates as to the cost of the construction on different power sites controlled by the members of the league.

TRANSPORTATION.

STOCKTON, CAL.—The Stockton Electric Railroad Company has filed with the board of supervisors an application for a 50-year franchise for a street car line to be extended out El Dorado street to Castle, in north Stockton.

BANKS, ORE.—There is a rumor that the United Railways Company's electric line will be built into Banks soon from its present terminus, a mile southeast of town. Passenger Agent Powers and L. G. Selfredge were in town gathering data to be placed before the company when considering the proposed extension.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company, from which the city purchases power for the Geary street railroad, has been notified by the board of public works, to prepare to furnish additional power for the extensions of the city's system. This power will be needed, the city engineer explains, on August 1st, for the Van Ness avenue and Chestnut street extensions; September 1st for the Potrero avenue line; September 15th for the Fort Mason extension, October 1st, for the Columbus avenue line; November 1st for Stockton street; December 1st for California street and on January 1, 1915, for the Church street extension.

SAN FRANCISCO, CAL.—The public utilities committee of the supervisors again has under consideration the proposition of making the property owners pay the entire cost

of paving unaccepted streets on which the Municipal Railway lines will run. Last year the committee favored this scheme, but on account of the change in the board's membership it is to be discussed again. It is admitted by the supervisors who support this proposal that if a private corporation were to build a railway on unaccepted streets it would have to pave between and on the sides of the tracks, but they think that the city should be exempt from this requirement. The question is to be talked over at the committee's meeting next week.

STOCKTON, CAL.—In the office of the county recorder last week was recorded the deed of the San Joaquin Valley Electric Railroad wherein all company property is conveyed to M. McCormick Company, which has taken over all the interests of the corporation to protect its end, following the recent foreclosure, and in order that money invested by it may not be lost. The Mercantile Trust Company of San Francisco, holders of the road's bonds, sold the property to Paul McDonald, a capitalist interested in the trust company, when the railroad defaulted in certain payments, and McDonald has turned the property over to the McCormicks. Whether T. K. Beard, the Modesto contractor, who controls the Modesto & Empire Railroad, will do anything toward recuperating the running stock is a matter of conjecture.

VANCOUVER, B. C.—The annual report of the B. C. Electric Railway Company to June, 1913, reflects to some extent the trade conditions in that province. The gross earnings increased $1,035,869, or about 17 per cent, hut practically the whole amount was absorbed by higher working expenses, due in part to the coal strike. These expensive working conditions are said to still continue and may affect the current year's earnings. The directors hope, however, to maintain the present rate of dividend by the recently announced increase in the fares and by reducing expenses wherever possible. The total money expended up to June 30, 1913, by the company, amounts to $45,168,312. The amount paid out in interest and dividends for the year totalled $1,888,139, equal to 4.18 per cent on the entire investment. In the past financial year the number of passengers carried was 71,973,822, an increase of 1,819,656. In the first year of operation, 1906, 12,395,582 passengers were carried.

SAN FRANCISCO, CAL.—J. K. Moffitt, chairman, United Properties Company trustees, and Frank B. Anderson, chairman, F. M. Smith advisory committee, issued a statement late Saturday confirming the completion of legal formalities whereby they have sold to George G. Moore and associates the control of the San Francisco-Oakland Terminal Railways. Mr. Moore will immediately take over the control, management and operation of these railways. "The settlement of the transbay railroad situation," the statement explains, "is coincident with an arrangement whereby Mr. Moore and his associates undertake the refinancing, development and advancement of the United Light & Power Company and the Union Water Company as soon as these corporations can be segregated and detached from the United Properties Company of California. This settlement disposes of all disputes existing among the three principles who consolidated these properties." John Drum, secretary of the Smith advisory committee, which has been administering the affairs of F. M. Smith for the benefit of his creditors, stated that besides settling the disputes between Hanford and Tevis and Smith, and the lawsuits filed by Hanford and his associates the agreement is of great advantage to the Smith creditors, because it will provide funds for the settlement of due obligations, provide for necessary development work, and the stock so sold, as payments thereon are made, will liquidate the indebtedness and tend to give a fixed valuation to the stock still remaining in the hands of Smith's creditors. The sale is contingent upon the extension of the $2,500,000 Halsey notes to September 12, 1914, and of the Key Route basin notes to November 20, and is of course subject to the approval of the state railroad commission.

TELEPHONE AND TELEGRAPH.

EDMONTON, ALTA.—Considerable expenditure will be made in the electric light and telephone departments, though this will not be quite as heavy as in 1913.

CENTRALIA, WASH.—The South Hannaford Telephone Company has applied for a franchise and authority to construct, maintain and operate telephone lines over certain county roads.

SAN FRANCISCO, CAL.—City Attorney Long has revived his recommendation for negotiations with the Pacific Telephone & Telegraph Company for the payment to the city annually of a percentage of its gross receipts as a compromise of the litigation over its absorption of the Home Telephone Company.

VERNON, B. C.—The Vernon Board of Trade has petitioned the provincial government for assistance in laying a telephone cable in Lake Okanagan to serve the district on the west side of the lake. The petition states that there would not be sufficient subscribers to justify the local company in making the outlay but that the company would undertake to buy back the cable as soon as that part of the system becomes self-sustaining.

WATERWORKS.

UNION, ORE.—The city officials are working out the problems of a charter for the city of Cove with a view to installing a new municipal water system.

EL MONTE, CAL.—Citizens of El Monte have voted on the matter of issuing bonds in the sum of $36,250 for the purpose of the construction of a municipal water system.

AVALON, CAL.—The Board of Trustees have accepted plans of the city engineer for a $68,000 water system and has ordered them submitted to the Banning Company for approval.

MANHATTAN BEACH, CAL.—Bids for construction of a municipal water system will be opened at the next meeting of the board of trustees. The improvement will cost more than $80,000.

ESCONDIDO, CAL.—The city trustees have purchased an acre and a half of ground as a site for a pumping station of the new city water system that is to be installed at a cost of $100,000 as soon as a market is found for the bonds.

BAKER, ORE.—Bonds in the sum of $44,000 were recently voted here. The proceeds will be used in the construction of the water system. The work to be done is the laying of 8000 ft. of cast iron pipe from the reservoir to South Baker. The sizes of the pipe to be laid will be 12 and 16 in.

OREGON CITY, ORE.—A resolution asking the city council of West Linn to make a formal offer to the Pure Water League of Oregon City to buy water from Oregon City in case that city built its line to the south fork of the Clackamas, has been passed by the West Side Improvement Club.

SAN DIEGO, CAL.—To issue $705,000 bonds recently voted for the improvement of the water system in denominations of $500 and $1000, is the plan of City Attorney Cosgrove, City Treasurer Stewart and Councilman Fay, who are now making the necessary arrangements. The city will first purchase the entire issue at par, then reoffer them for sale.

CALGARY, ALTA.—Water Engineer A. W. Ellison Fawkes gives the cost of a waterworks system in four different estimates, on constructing gravity lines to different sites for storage dams 39, 38, 36 and 32 miles from the city, with the following respective costs: $2,159,673 for the 39 mile; $2,128,763 for the 38 mile; $1,977,322 for the 36 mile, and $1,718,343 for the 32 mile. The alternate scheme of pumping water from the Bow River with a big filtration plant, Mr. Fawkes estimates, would cost $1,119,835 for a 40,000,000 gallon supply and $807,657 for a 20,000,000 gallon supply.

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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SCHOOL ROOM LIGHTING.
BY R. W. MYERS.

PUBLIC UTILITY COMMISSIONS AND PUBLIC SERVICE CORPORATIONS
BY W. D. SCOTT.

SATURATION POINT IN ELECTRIC EARNINGS.
BY H. C. STODDARD.

ELECTRIC HYDRAULIC MINING.
BY N. K. COOPER.

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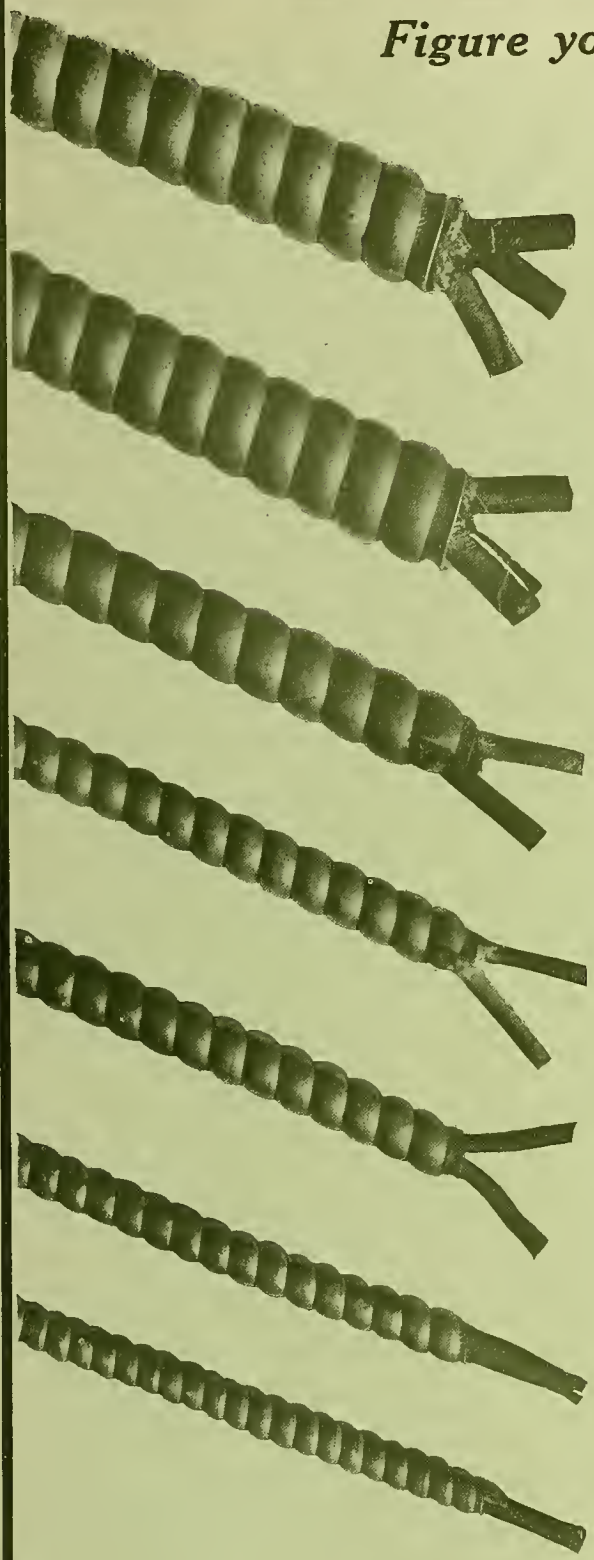


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JOURNAL OF ELECTRICITY
POWER AND GAS
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VOLUME XXXII SAN FRANCISCO, JANUARY 31, 1914 NUMBER 5

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ELECTRICAL HYDRAULIC MINING

BY N. K. COOPER.

(This is a description of a successful method of gold mining hydraulically which is applicable to those places where the gravels are too shallow to permit satisfactory dredge operations. Costs of installation and operation are given.—The Editors.)

The experience of the early hydraulic miners in California paved the way for the development of hydroelectric power. Today that power is in turn making hydraulic mining possible in many cases where water is scarce, or the head not great enough for economical operation. Many of the gold-bearing gravels of California also cannot be profitably dredged because they are so shallow or the bedrock is so uneven as to make dredge operation unsatisfactory, if not impossible.

These difficulties have recently been solved by a unique installation near Loomis, California, where The Associated Miners are now working about sixty acres of level gravel, averaging twelve feet in depth.

The system centers about a 400 h.p. motor driven pump, which performs the double duty of supplying water under 250 ft. head for a giant, which washes down the gravel, and also to a hydraulic elevator, which raises the gravel to sluice boxes. This pump is a 12 in. horizontal 2-stage series Byron Jackson centrifugal, driven at 1160 r.p.m. by a 400 h.p. 2200-volt Westinghouse motor, to which it is directly connected. The pump handles 4500 gal. of water per minute under the 250 ft. head.



Comprehensive View of Hydraulic Giant in Operation, showing Hydraulic Elevator and Head of Sluices.

In starting operations a pit was first dug for the elevator, and a line of 15 in. pipe run to the elevator and lines of 14 in. pipe to two giants placed around the elevator. While only one giant is operated most of the time this arrangement enables the bedrock to be washed, even in deep crevices, and to be cleaned

up by the streams from the giants with but little hand work. Each of these giants has a 2½ in. nozzle, and is of standard California construction.

The hydraulic elevator lifts the gravel a vertical height of 33 ft., and discharges it into a long line of elevated sluices, where the gold is caught in riffles and undercurrents and whence the water runs into a settling basin. The elevator has a 9 in. throat and 3½ in. nozzle, and handles from 150 to 200 cu. yd. of



The Operator's Point of View.

dirt per hour. The sluices are 500 ft. long and have a drop of 7 ft. in 12 ft., from head to tail. Water for operation, 400 miners' inches, is originally obtained from a small reservoir constructed by damming the ravine, and after operation has been started most of the water is obtained from a settling basin into which the material is dumped at the end of the sluices. The water from the settling basin is thinned at the pump by means of a small stream continually running from the reservoir, the proportion being about one part of fresh water to four parts of settled water.

Electric power is obtained from the Great Western Power Company, who installed two 250 k.v.a. transformers, which step the current down to 2200 volts. Power is supplied at the minimum rate of $400 per month, with the right to cease operations during July, August and September in case water fails. With the plant operating continuously day and night the maximum cost of current is $1700 monthly.

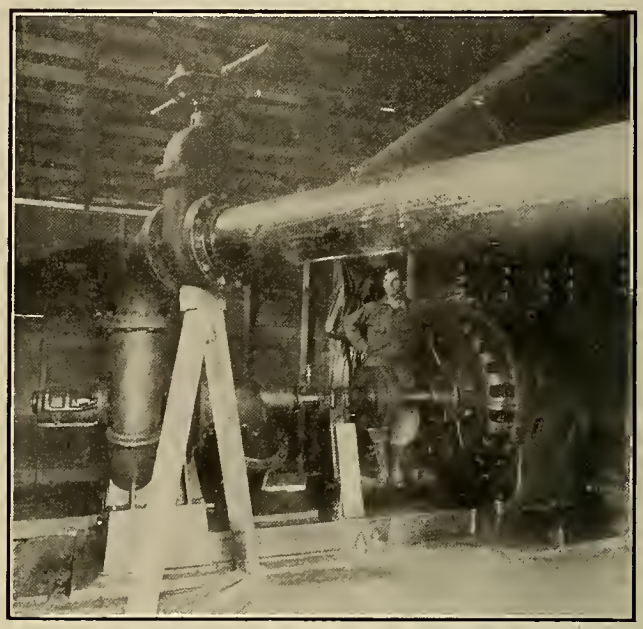
In operating the system six men are necessary during the day and four when operating at night, the extra two men during the day doing such odd jobs as keeping the banks of the settling pond in repair and cutting down trees ahead of the giant.

Following is an itemized statement of costs of installation:

Cost of Hydraulic Gold Mining System.

Centrifugal pump, f.o.b. Berkeley	$1,770.00
400 h.p. motor, f.o.b. San Francisco	1,897.00
Freight	50.00
Hydraulic Elevator, (special price)	500.00
Two giants	237.00
Sluices	250.00
Tools	200.00
Camp Buildings	1,000.00
Labor	1,000.00
Incidentals	500.00
Pipe	1,400.00
Total	$8,804.00

The experience of this plant has been so satisfactory that several others are now in contemplation, ranging in size from 400 to 1000 h.p. of installed capacity. As there are many similar gravel deposits throughout the state, which cannot be profitably mined under the old conditions, this unique method should be of considerable value in working them. Credit for originating and developing the idea is due to Mr. Samuel C. Laird, of Loomis, and Mr. S. D. Woods, of



Interior View of Pump House.

San Francisco, the latter having backed the plan financially.

Results show that the power consumption is about half that of the average dredge handling the same amount of material, but as it can be used where a dredge cannot be operated, it certainly offers an excellent load for the power company.

The Diesel four-stroke cycle is that under which most Diesel engines operate. During the "admission" stroke, the piston travels downward and the cylinder is filled with air only. During the "compression" stroke the piston travels upward and this air is compressed to 500 lb. per sq. in. and its temperature is thus raised to about 1000 degrees F., which is hot enough to ignite any liquid fuel injected into it. Just before the piston reaches the upper end of the compression stroke the fuel valve opens and a measured quantity of fuel oil is gradually sprayed into the cylinder until the downward "power" stroke is about one-tenth completed, as a result of its expansion. Finally during the "exhaust" stroke the piston travels upward and the products of combustion expelled from the cylinder through the exhaust valve, thus completing the cycle. The quantity of oil delivered to the spray is adjusted so that the pressure does not rise above the compression pressure during the "power" stroke, this amount being regulated according to variations in load by the action of the governor on the fuel pump. It is usually injected at about 750 lb. pressure by cool air from a compressor driven from the engine shaft.

EFFECT OF FORESTS ON RUN-OFF.

BY J. C. STEVENS.

(Continued.)

When spring comes the melting first begins in the open during the days, with freezing at night; while in the forest practically no melting occurs. As warm weather advances the snow on the exposed portions in the open is gradually melted and the drifts begin to supply some water, but no floods can ever be caused from slow melting of deep snow drifts. The snow drift, especially in the higher altitudes, is an important conserver of precipitation. It continues to supply water to the streams long after the even blanket of snow in the forest has entirely disappeared.

The advance of spring under forest cover has an entirely different effect. The snow gradually compacts, the volume becomes less but without reducing the surface exposed. When warm weather really comes and the temperatures during both day and night are above the freezing point, the even blanket goes off with a rush, frequently causing higher water than if the same volume had been deposited in the open. True, the maximum rate of run-off from the forest occurs later than if the area was open country, but the value of this maximum is generally greater. This delay might be useful if it extended the melting period well into the summer, but the delay is only a matter of a few days at most and after it is past the flow diminishes much more rapidly than after the maximum from the melting of snow drifts in the open.

Do Forests Diminish Floods?

This feature of the forest question has been touched upon in what has preceded, but the belief is so general that forests have an enormous influence in reducing the height of floods that the subject deserves special mention.

It may be true that the forest cover has a moderating effect on medium stages of a stream, but even this has not been demonstrated beyond question. Certain it is that great floods in rivers are not diminished in the slightest by forests on their headwaters. Great floods are always caused by excessive rainfall, frequently attended by sudden melting of snows. On the Pacific Coast the "Chinook" wind is the most frequent cause of heavy floods. This has its counterpart in the "foehn" of Switzerland. There, dry, warm winds have been known to melt as much as three feet of snow in fifteen hours. Under such an influence the even blanket of snow in the forest is particularly susceptible to quick melting and gives rise to greater floods than the same volume of snow would from its usually drifted positions in the open country.

It requires a relatively small quantity of water to sufficiently saturate the litter in a forest floor to permit rapid run-off. It is not necessary that this forest litter become completely saturated before run-off occurs. Mention has been made of the "thatch" that leaves sometimes form over the surface of a forest floor. This is particularly effective in deciduous timber after the spring snows have been melted. In our western forests I have seen large areas in the spring completely covered, almost as effectively as if shingled—by the leaves of maple, alder and other deciduous trees and brush. To a less degree the needles of conifers also may prevent complete saturation of the forest litter and humus before rapid run-off begins. But even if it be admitted that complete saturation must occur before water begins to run off, the amount of water so required is too slight to appreciably diminish the height of floods. It can only diminish the moderate freshets. These freshets are not the controlling feature in design of structures either for river improvement or the utilization of water supplies. It it always the maximum that governs.

On large rivers serious floods are produced by combinations of flood waters from tributaries arriving simultaneously. Such combinations result from the peculiar distribution of rains over the area and are beyond human control. In many cases retardation of the flood from a forested portion may cause a more disastrous combination than if that particular contribution had not been retarded. However, no general conclusions can be drawn from these circumstances, each area and each flood on it being a law unto itself.

If forests mitigate floods, they can only accomplish the result either by storing a considerable portion of the precipitation or by mechanically retarding the run-off to produce a beneficial combination. A uniform retardation over the whole area will not lessen the maximum run-off, it only delays the time of its occurrence, while a non-uniform retardation, as we have just seen, is just as likely to be harmful as beneficial. We have also seen that the storage capacity of a forest is very limited. In countries of heavy rainfall this storage, in so far as it does exist, is beneficial, but in countries where the total water supply is required, it is a positive detriment since this amount is not returned to the stream but is permanently removed from the water supply of the region.

Do Forests Increase Low Water Flow?

In view of the fact that the forest is a heavy consumer of water, and that the ground water level under a forest cover is substantially lower than in the open country, there is positively no evidence upon which to base an affirmative answer. During the summer months stream flow can only be maintained by drawing on water previously stored in snow banks and in the ground, or by the run-off from summer showers. In the open country snow drifts continue to supply water to the stream long after the snow has disappeared from the forest.

The light summer shower certainly adds little to run-off from a forested region, for it is usually absorbed completely by the crowns and forest litter. But in the open country the same shower may produce considerable run-off or add something to percolating water.

Since the water stored in the humus is not returned to the stream, but is evaporated, the only thing left to increase run-off is the increment to ground water induced by a forest cover, and we have seen that this is small in any event and is just as likely to be a decrement. The conditions in summer in a forest are these: moist litter and top soil, dry stratum where tree roots penetrate, moist soil, and ground water below. In the open country the conditions are: dry top soil, then moist soil merging into ground water. Of the two conditions, the open country will probably furnish the greater amount of percolating water, other things being equal. The differ-

ence, however, is seldom great enough to be of economic importance one way or the other.

Summary.

I will briefly sum up the pertinent points relating to the general influences of forests on climate, precipitation and run-off.

In spite of the general belief that forests have a great mitigating effect on floods, induce great lower water, and favorably influence the climate of a region, it is seen that a rigid analysis of the process by which this influence is said to be exercised leaves serious doubts as to the efficacy of forests to fulfill these claims. We have found that:

1. Forest litter and humus do not necessarily induce greater percolation of water into the underlying soil than would obtain in the open, and wherever it does have this effect the increment to ground water is offset by the excessive use of water by transpiration and for the growth of trees. In porous soils, a forest cover may effectively prevent percolation.

2. Forests may absorb and dissipate intermittent showers without permitting any run-off or percolation. In the open, however, such showers always produce some run-off or add something to ground water.

3. Ground water level in forested lands is lower than in the open, owing to excessive use of water for plant growth. This reduces the water available for stream flow during the summer (growing season) and instead of adding to the low stages of streams, the forest in reality deprives the streams of the water so consumed.

4. Forests prevent the formation of snow drifts, which is recognized as an important storage agency for keeping up the summer flow of streams. The melting of the uniform blanket of snow under a forest cover is somewhat delayed in time, but may induce higher floods than could possibly come from melting in the open.

5. Floods are not reduced by forests. Once saturated, the forest has no further ability to retain water, and the run-off proceeds as completely as in the open. The amount required for saturation is small and can only affect the medium freshets to a small degree.

6. The amount stored after each rain in the humus is not returned directly to the stream, and but rarely given up to the soil. It is virtually lost by slow evaporation and the transpiration from smaller plants on the forest floor.

7. The net effect of these influences is that the total run-off from a forested area is less than that from an open area, other things being equal, and that the uniformity of stream flow is not improved.

8. Forests do not increase precipitation. The influences they exert through increased evaporation, decreased temperature or convection currents are altogether impotent to accomplish this result. Precipitation is caused by forces of much greater magnitude.

Soil Erosion.

There is a widespread belief that forests are necessary for the prevention of soil erosion. But with this, as with the other features connected with the forestry propaganda, there is a wide difference between the actual benefits secured and those popularly attributed to the forests.

Only in a few special cases has it been proven that the mere cutting down of trees resulted in harmful erosion of the land. Wherever forests have existed in the past, some growth is sure to follow the removal of them. Such a growth is generally of different varieties, but its efficacy in preventing soil erosion is no less. All things considered, small underbrush and the tangled mass of ferns, vines, grasses and the other small growth that inevitably follows logging operations or fire, are even more effective in preventing soil wash than the virgin timber.

In a few cases where soil is scanty, slopes steep, and rainfall abundant and intense, the delicate balance between permanency of soil and the tendency to wash is disturbed by the removal of trees, and erosion follows. Such instances, however, are specifically local, affect comparatively small areas, and it is not just to draw general conclusions from them.

It is only on sloping ground that there is any tendency to erode, in any event, and any kind of growth tends to prevent it. Experience has shown that grasses are more effective in preventing erosion by water than any other single agency. On the other hand, erosion by wind is more effectively prevented by large timber, while a dense cover of small brush, chaparral, etc., will prevent the combined effect of wind and water erosion better than either.

Erosion of soil by water results from the cultivation of lands, the building of roads, trails, logging chutes, etc., etc., and not from the mere removal of timber. This statement is worthy of emphasis. Erosion almost invariably results from some development process that man has initiated. I have seen deep gullies in a grass covered field that began by water running in the wheel tracks left by one wagon driven over the surface. Elsewhere in the field the grasses effectively prevented soil wash. We can, therefore, only hope to prevent soil erosion in so far as we can dispense with these development processes.

Soil erosion has been an element in determining the topography of the country since time began, and will continue to be an important factor. All valley lands have been formed from soil washed from the adjacent hills. Rocks on the hills disintegrate and are gradually washed by rain and carried by the streams to lower elevation. Thus all agricultural lands have been formed. Where one part of the country is the loser, another portion gains by this process. We cannot prevent it and ought not if we could. There is not the slightest evidence that the annual burden of silt and soil carried by the rivers of the country has appreciably increased since man's occupancy of it.

Forests are cut for some specific purpose. If for the timber only, a new growth soon springs up even in the abandoned roads and trails and in a few years heals all the scars man has made. If the area has been severely burned, this growth is delayed, but it will eventually follow and the erosion which has increased during the time of recovery will gradually decrease until a balance is once more established. If the area is cleared for agricultural purposes, erosion may continue to the detriment of the

owner, but someone else further down the stream is the gainer. We cannot dispense with agricultural lands, and the solution of the problem rarely lies in reforesting the area but in adapting agricultural methods to meet the conditions. The change from forest to meadow lands and pasture never increases erosion, and it is possible to so plow lands on fairly steep slopes that excessive erosion will not follow.

We hear a great deal about the rocks and debris from deforested hills filling the river channels and covering the rich valley lands. The careful observer will find the same thing is true where virgin forests exist, and in addition we have the river channels filled with drift, uprooted trees, and timber debris of all kinds. Excessive flood heights in wooded countries are frequently caused by drift jams in the river channels, new channels are cut and valley lands flooded. Damages from such causes are not insignificant, and menace habitations contiguous to virgin forests as surely as those adjacent to cut-over lands.

In this matter our ills are purely relative. We cannot dispense with agricultural lands, and we cannot dispense with works of development and improvement; neither can we prevent soil erosion. Certain local conditions may be improved by local treatment. In many instances unnecessary damage has been done, but we must not draw the general conclusion from such isolated cases that the removal of forests is always a menace to the welfare of the country.

A Study of Existing Data on Forest Influences.

If the conventional forestry theory is correct, we should be able to detect the influences claimed for them in records of run-off from areas where material changes have taken place in the forest cover of the drainage area, during the periods of record. Such an analysis should deal with simultaneous records of precipitation and run-off covering a long period of years both before and after the change in forestry cover occurred. As before stated there is no fixed relation between run-off and precipitation, even on the same watershed. Each year precipitation is different in amount, distribution and intensity, and the run-off necessarily exhibits the same general fluctuations. These quantities, however, only fluctuate between certain limits, hence if the records are accurate and of sufficient length, the average for both conditions of forest cover should exhibit the changes, if any, for which the forest is responsible.

The unfortunate thing is that existing records are not of sufficient accuracy nor of sufficient length and completeness to warrant an exhaustive analysis to determine the actual influence of forests. We can not, therefore, expect to show the actual influences of a forest cover, but we can show the limit beyond which this influence does not extend, which is of no small importance. It will be found that this limit is infinitely small compared with the popular belief in its magnitude, that is to say, the actual influence of a forest in modifying run-off is too small to be detected in any existing records, while it is generally believed to be of the first magnitude and importance. The data used for this study are of the same quality as to accuracy and completeness as are those on which are based the expenditures of large sums in development works for the utilization of water supplies, and they are sufficiently accurate for those purposes.. If, then, an influence is so obscure that it cannot be detected by the same process by which we secure the data on which are based the developments of water supplies, can this influence be of economic importance?

(To be continued.)

CENSUS FIGURES ON ELECTRIC LIGHT AND POWER.

Preliminary figures of the forthcoming quinquennial report on the central electric light and power stations of the state of Nevada have been given out by Director W. J. Harris, of the Bureau of the Census, Department of Commerce. They were prepared under the supervision of W. M. Steuart, chief statistician for manufactures.

The statistics relate to the years ending December 31, for 1912 and 1907, and June 30 for 1902, and cover both commercial and municipal electric plants. They do not include electric plants operated by mining companies, factories, hotels, etc., which consume the current generated, those operated by the Federal government and state institutions, or plants that were idle or in course of construction.

The figures as presented for Nevada show that during the decade 1902-1912 there were substantial gains in the industry. In the estimated number of arc lamps wired for service, 321 there was an increase of 312 per cent, while the increase of all other varieties was 37,230, or 453 per cent. In the case of the aggregate income of the eight establishments reported in 1912 there was a gain of $574,393 over 1902. There were also large gains (797 per cent) in total horsepower reported, the output of stations in kilowatt hours, and in the number of stationary motors served and their horsepower capacity.

The number of persons employed in 1912 was 147, an increase of 129, or 717 per cent, over 1902.

The figures in detail are shown in the accompanying table:

	Nevada.			Per cent of Increase: 1902-1912.
	1912.	1907.	1902.	
Number of establishments	8	9	5	60.0
Commercial	7	9	5	40.0
Municipal	1	..	..	....
Income	$618,942	$372,108	$44,549	....
Light, heat and power	$607,597	$352,959	$44,549	....
All other sources	$11,345	$19,149	.....	....
Total expenses, including salaries and wages	$428,255	$245,291	$39,687	979.1
Total number of persons employed	147	78	18	716.7
Total horsepower	15,420	6,980	1,720	769.5
Steam and gas engines (including turbines):				
Number	14	9	4	250.0
Horsepower	2,880	695	250	.....
Water wheels:				
Number	13	9	4	225.0
Horsepower	12,250	6,260	1,470	753.1
Auxiliary engines:				
Number	(1)	1	.....	.....
Horsepower	(1)	25	.....	.....
Kw. capacity of dynamos	10,513	5,690	764	.....
Output of stations, kw.-hr.	44,969,772	29,621,730	1,508,910	.....
Estimated number of lamps wired for service:				
Arc	321	[2] 327	78	311.5
All other varieties	45,443	[2] 63,939	8,213	453.3
Stationary motors served:				
Number	303	411	13	.....
Horsepower capacity	12,384	6,850	180	.....

[1] Not reported separately.

[2] Exclusive of 1 arc and 692 lamps of other varieties reported by the electric companies as used to light their own properties. Lamps used for such service were included in the number reported for 1912.

LIGHTING METHODS

SCHOOL ROOM LIGHTING.

BY ROMAINE W. MYERS.

(The necessity for good school room lighting and its arrangements are first mentioned and a properly designed installation then described in detail. Mr. Myers is a consulting and illuminating engineer, Oakland, Cal.—The Editors.)

Public school houses of our large Western cities are quite often used for evening classes, so that the question of proper lighting is of considerable consequence. The importance of good illumination in rooms where students are working, cannot be overestimated.

We have read a great deal in the past few years regarding the conservation of natural resources, but how about the conservation of this greatest of nature's

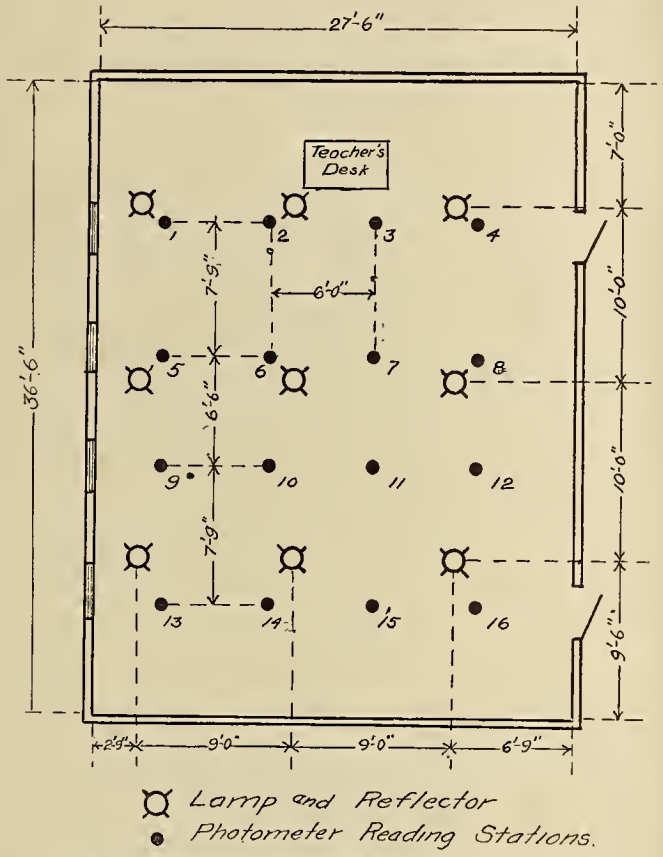


Fig. 1. Floor Plan of School Room and Location of Test Stations.

resources—the eye of the child? This should receive more attention, in fact, if this were so, the doctors employed to investigate the health of school children would have their labors considerably lessened.

Improper or insufficient lighting produces a disturbance of the balance of the retina, affecting the nervous system thereby also causing headaches, etc. The danger that children are subjected to when the equipment violates every requirement of proper lighting is evident, and the possible loss to the nation equally obvious.

It is a serious enough handicap for children to have to attend night school to obtain an education. The fact that by doing so they are subjecting themselves to an obstacle so serious as to impair their eyesight should be remedied. Poor lighting has more to do with intermittent or non-attendance at night schools than any other cause. Good lighting methods will ensure better health and better results from the students' efforts.

Until recently architects, school boards and teachers have been perhaps pardonably, but nevertheless, sinfully lax in providing the best lighting possible for the rising generation. This is because they have been either absolutely indifferent or ignorant of the physiological requirements of artificial lighting. It is time that all should realize that the eyes of the children in their charge, are of more importance than the decorative features or artistic effect of the lighting fixtures in the school room.

An example of good lighting installed in two rooms of the Oakland High School, Oakland, Cal., is shown in Fig. 1. This is installed at a minimum of expense and consists of placing the outlets unsymmetrically with reference to the rows of desks, so that the shadows on the pupil's desk will fall from left to right. Nine outlets are shown, each being equipped with No. 247 Asymetrical Holophane reflectors, with 100 watt bowl frosted lamps.

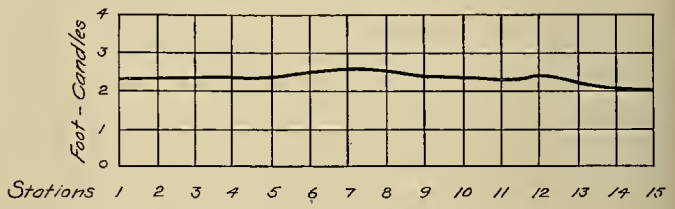


Fig. 2. Uniformity of Illumination on Desks.

Horizontal readings in foot-candles were taken on desks at points shown in Fig. 1 with a photometer, the readings of stations being as follows:

Illumination Readings.

Stations.	Foot-candles.	Stations.	Foot-candles.
1	2.3	9	2.35
2	2.3	10	2.35
3	2.3	11	2.3
4	2.3	12	2.4
5	2.35	13	2.15
6	2.5	14	2.10
7	2.6	15	2.0
8	2.5	16	2.1

With the test stations located as shown, there was obtained a value of 2.3 foot-candles as the average.

Fig. 2 shows graphically the uniformity of the illumination produced.

The height of room is 10 ft. 0 in., the center of lamps being 9 ft. 6 in. from the floor. The ceiling is of comparatively light color with the customary blackboards on the walls. These blackboards are also very satisfactorily illuminated, specular reflection being entirely absent.

The reflector used extends down, covering the lamp so that it is not in the line of vision, thus eliminating glare and providing good diffusion, which with proper direction means good lighting.

METHOD IN HOME LIGHTING.

(Continued.)

4. Entrance Hall.

To greet guests amid the depressing influence of dim lighting or under a glaringly brilliant white light is not desirable. The ladies, especially on arrival, desire to appear at their best, and this is not possible with either of these extremes or under a direct light casting heavy shadows. The end desired is accomplished by the installation of a so-called, warm tone of light, properly diffused.

It can be secured in a variety of ways, and by the use of all three fundamental systems of lighting.

It is thought by some that just sufficient light in the entrance hall to permit the removal and disposal of wraps is all that is needful and very low intensities have been recommended.

This does not, however, agree with good practice in the West. Rather it is an outgrowth of those days in which it was necessary to leave the gas burning so as to save the trouble—a real trouble too—of lighting the jet whenever a summons to the door had to be answered. In those days, the blackened ceilings and walls—more so here from the draught blown gas jet than in any other part of the house—were not inviting, and the main object was not so much to illuminate as to conceal these defects.

With the porch or veranda light burning continuously and the greater ease in switching electric lights on and off, it is not necessary to leave that burning in the hall, and it is used for so short a time, that economy in the size of lamp is not essential.

The "opal" ball is popular for this lighting but more pleasing and more ornate effects can be obtained by the use of indirect and semi-indirect systems.

A large variety of wrought iron and pendant fixtures can also be advantageously used provided the glassware is carefully selected as to warm color of transmitted light and good diffusing power.

Pompeian lamp designs and adaptations of these are also both popular and pleasing. Cairo or Arabian lamps, Turkish and other Oriental lantern effects can also be properly used, the silk draperies being very pretty.

In the entrance hall are the switches for the porch or veranda lights, the garage and outside lighting and the hallway light. These should be all, three-way.

5. Living Room.

The dark furniture and furnishings usually installed in the living room absorb the light.

It is a well-known fact that white light is composed of all the colors of the spectrum, but it is not so generally understood that no objects have any inherent color of their own, but reflect a hue which is the sum of all the colors of the spectrum other than those absorbed by them.

To illuminate means to decorate. An illuminated object is literally painted with light.

This "painting" process is most expensive when the light falls upon dark objects for it can then illuminate them only to a very low intensity. Light reflected from the walls of a room also contributes to the better illumination of other objects, but if all the light impinging on the walls is lost, or absorbed, on account of dark wall paper, then additional light must be provided. Dark objects thus prove a perpetual expense.

For the so-called "warm" appearance of a room, dark furnishings are not an essential.

In the living room it is more economical to install a system which will provide a low intensity of general illumination and greater localized intensities wherever desired. This would necessitate at least one good reading lamp. For the piano, a special lamp would also be required.

It too often happens that these lamps are selected only because of their artistic or pleasing appearance. Utility—their fitness for the practical purpose for which they were designed, is of even greater importance.

Good diffusion of the light over the surface illuminated should be the prime consideration. This may be secured, though inefficiently, by using totally frosted lamps. There are, however, many practical portable lamps now on the market. They should not have too great a surface brilliancy, that is, they should not transmit too great an amount of light and should reflect the light diffusely in a useful direction. If the lamp reflects specularly or too great an amount of light comes direct from the bare lamp, very noticeable striations—streaks of bright light—appear on the surface illuminated. This is not only objectionable in appearance, but causes the eye to rapidly tire.

Where no provision has been made for the use of portable lamps, outlet boxes for this purpose may be readily and usually inexpensively installed with positively no damage to existing decorations.

If a system of general illumination only is desired and dark wall decorations also selected, it is advisable both on account of ocular comfort and relative economy to install an indirect system.

Glare, which causes considerable eye-strain and irritation is a condition resulting not only from the us of bare lamps, but occurs also when there is a great contrast between a luminous lighting unit and the ground against which it is viewed.

The influence upon the cost of light where dark decorations are used has been mentioned.

Between indirect lighting installed in a room with light walls as compared with dark, it is about twenty per cent, whereas with direct lighting and the use of comparatively efficient lighting glassware the difference approximates fifty per cent.

On account of the better quality and distribution of the illumination under these conditions, indirect lighting may be considered more efficient, although it would take practically the same quantity of light with these two systems to produce the same illumination intensities.

Semi-indirect lighting would not be as efficient as either and if decorative or art glass shades were to be used the efficiency would be extremely low and satisfactory lighting practically impossible.

Where indirect lighting is installed the ceiling should not be a flat white but delicately tinted to harmonize with the other decorations.

[To be continued.]

PUBLIC UTILITY COMMISSIONS AND PUBLIC SERVICE CORPORATIONS.

BY W. D. SCOTT.

(This paper which is a review of the better business relationship between public utilities and their customers resulting from commission control, was presented by Mr. Scott at a recent joint meeting of the Portland Section A. I. E. E. and N. E. L. A.—The Editors.)

The public service business as a whole can be considered a comparatively recent development. Until within the last few years the executives and stockholders of public service corporations regarded inquiries concerning their business by individuals or government authorities an infringement of their personal or charter rights. This spirit, when evinced by individuals or smaller corporations, could not, in itself, be regarded as harmful to the general public. In a measure, no doubt, the attitude of the larger public service corporations was an outgrowth of the sentiment of the individual which dislikes public criticism of private matters, which feels that his business, is his business, and if through accommodating a greater number of patrons his business nets him a better rate of return, then, the methods which he uses are his methods and are not subject to regulation by others.

With the increased volume of business under one control which follows the consolidation of small industries into larger ones, and the fact that a great many of the so-called public service corporations of today are of necessity in the nature of a monopoly, considerable injustice might result to a large number of people should the judgment or sentiment of these corporations not be based on a broad minded and liberal policy.

The very fact that the complexity of the business does not permit of all of the customers being taken into the confidence of the corporation, and does not permit of the various operating steps of the corporation being fully and carefully explained, has resulted in many misunderstandings and much dissatisfaction.

A large corporation must of necessity deal in averages. It is particularly difficult to convince an individual customer, who has a complaint, that it is only reasonable that mistakes and errors will occur. If this customer is treated as an average case and is shown that his complaints are known, that he represents but an average unit out of the total number of units, a natural sense of dissatisfaction results. He must be treated as an individual.

Laying aside all matters of finance and questions of deliberate dishonesty, roseate promises of promoters and the sale of service for less than actual cost, the customers of public service corporations have, in many instances, come to distrust the officials and employes of corporations. This misunderstanding has often resulted through the fact that the particular employe, who met and answered the complaints of the particular customer, did not occupy a position which enabled him to have all of the facts at hand for explaining the ways and means of the company's policy.

With subdivision of authority and minute specialization it becomes difficult to educate a sufficient number of employes, whose general knowledge of their particular business is broad enough to enable them to discuss intelligently the business policy and methods of their particular company. In many instances even the men who occupied the larger executive positions were in doubt as to just why a certain charge for service was a reasonable charge or why a certain line of policy was best for all of the customers. The principal difficulty existed through their inability to present their side of the case from their customer's point of view.

When rate investigations were first started with common carriers a phrase was used in connection with the matter of establishing rates which called forth considerable adverse comment. "All the Traffic Will Bear," was the term which brought down upon a great many railroad officials very severe criticism. If, at the inception of such investigations the larger executives had been able to explain that this phrase did not mean all of the possible revenue to be extracted from any given set of customers, irrespective of its effect on the prosperity of the community in general or the common carrier in particular, a large amount of unjust criticism would never have been made.

There is none but will concede, that, in order to exist, and in order to secure the necessary capital for future extensions, any utility must receive sufficient revenue to enable it to satisfactorily carry on its business and earn a return upon its investment which will satisfy the investors who placed their money in the business and expect security and income.

If the phrase "All the Traffic would Bear," was translated to mean not greedy extortion by overcharges, but the minimum rate which would insure a reasonable return upon the investment and at the same time put the extension of the company's business to its greatest possible limit for the benefit of the whole community no such odium as now exists would be attached to it.

When some customer brings up a particular rate for a particular class of service and the public service corporation is not able to show definitely and exactly that the rate or charge is based on service costs, the customer or individual naturally begins to suspect that other statements made by any representative of any corporation are subject to investigation.

The general dissatisfaction among the customers of large corporations has brought into existence various regulating bodies. These regulating bodies investigate the condition of the corporation, both from the question of rates charged to customers and from the question of financial responsibility to investors. The customer and the investor have more confidence in a statement made by a third or disinterested party; has come to learn that rulings as handed down by the various commissions are not the matter of snap shot judgment, but are judgments rendered after due deliberation and the presentation insofar as possible, of all facts bearing on any particular case. Various regulating bodies maintain inspectors or representatives, who explain the physical operations necessary to serve the customers of any utility. Operating difficulties are explained and made clear not by a supposedly biased employe, but by someone whose position inspires confidence.

The right minded public service corporation cannot help but feel that through this representation it has the best advocate before the people that, up to the present time, has been considered. Without public confidence, no matter how hard its officials and employes may try to render adequate service, their difficulties will be constantly increased. They may render the best possible service at a reasonable charge but due to the fact that they are not able to give that personal touch to all of their business relations, which exists in small companies, they will never gain the complete good will of all their patrons.

The bright light which has been thrown on a number of corporation practices, the publicity given by investigations of public service commissions and the presentation of the real facts, has been of much assistance towards helping solve many of the unsolved problems for enterprises which are endeavoring to give a satisfactory service to the public.

It took some time at first to overcome the spirit of the individual who resented outside investigation and to establish the fact that a public utility should be managed for the public good. If the various regulating bodies may achieve but this one thing—the return of the confidence of the general public, their efforts and the expense entailed will be worth while.

The publicity given all public service matters cannot help but bring about a higher standard of business honesty and promote a spirit of fairness to all.

There has been a general awakening on the part of public service corporations that their motto can never be 'The Public Be Damned," but "The Public Be Served."

PRIVATE VS. LEASED TELEPHONE LINES.

(The following interesting item is abstracted from the Discussion on Mr. R. W. Van Norden's paper on the Lake Spauling-Drum Power Development, read before the San Francisco Section, A. I. E. E., and published in the Dec. 13, 1913, issue of this journal.—The Editors.)

A question was asked by the chairman, Mr. A. H. Griswold, relative to the statement made in the paper that there were no telephone lines carried on the transmission towers, as to how the dispatching and so forth is handled; whether by a separate line or lines already in existence, or how?

The question was replied to by Mr. Downing, who said:

"We have found the lines of the telephone companies so very much more satisfactory than lines strung on the power circuits that is was not considered necessary to go to that expense. However, speaking seriously, I might say for the information of those who do not know how we handle our dispatching, that we have a leased circuit from the telephone company running directly from our dispatchers' office in Oakland to Drum power house. In fact, it runs right from our general office here in San Francisco, to the plant. This line connects into our switching station at Cordelia, and into other important switching stations over the entire system. We may eventually put a telephone circuit on the towers. Our original plan called for such a circuit, but it has not been constructed up to this time."

THE SATURATION POINT IN ELECTRIC EARNINGS.

BY H. C. STODDARD.

(In this article the author reviews the possible business which may be secured from different classes of customers. Central stations should sell service. The saturation point will never be reached while such service can be sold to the profit of each class of consumer.—The Editors.)

Earnings from Residence Customers.

The average family can afford to pay only a very limited percentage of their income each month for lighting. Although electric lighting is continually becoming cheaper and more efficient, customers use more light, and demand a better standard or quality of illumination. In this way, the percentage remains constant.

Families having a revenue of $100 per month or less, will object to paying an average light bill of over say, $1.36 per month, but they will usually have no objection to paying 50c per month more for the use of an electric iron, partly on account of the saving of fuel and partly on account of the convenience and saving of labor to the overworked housewife.

They may frequently be induced to add additional amounts to the bill for the use of a vacuum cleaner and possibly, an electric washing machine, if supplied with these utensils on terms that do not make the first cost excessive. They will frequently use and pay for other items of electric service and convenience even if necessary to curtail some other items of expenditure.

Families having a greater income than $100 a month, especially where the amount will permit the employment of help, will often, on account of the uncertainty of this factor, be easily induced to increase the amount of their lighting bills, especially if it can be shown that certain electric home labor saving conveniences remove dependence upon this uncertain human element, which is generally inefficient also, and wasteful.

The estimated cost of fuel for cooking for a family having an income of $150 per month, is $4.68 per month. Such families should be easily induced to pay the slightly additional cost necessary to electric cooking, and might also be persuaded to use some temporary electric heating device, such as the luminous radiator.

Those customers who have an income of over $200 per month should, through wise solicitation and comprehensive educational effort on the part of the lighting company be induced to use electric service for everything. The difference in cost between electric and other means of lighting, vacuum cleaning, ironing, cooking and water heating is so small that the customer may easily be persuaded to use electric service, on account of its cleanliness, convenience, freedom from danger, smoke or gas.

The electric vehicle is also a probable source of revenue from customers having the larger incomes.

Under favorable conditions and with warmly built houses, customers having such incomes could afford to do all or part of their heating by electricity. The labor saving and cleanliness, as compared with the dirt and inconvenience of wood or coal heating will,

if properly presented, go a long way towards offsetting the difference in cost between these two methods, and in persuading the customer to adopt the electric way.

The average residence customer while willing to pay only a small sum for lighting, will gladly pay one much larger for service, and every electric service that can be supplied customers in the way of current for operating irons, vacuum cleaners, washing machines, cooking appliances, electric water heaters and electric air heaters, will result in much better satisfied customers, and bigger returns for the central station.

Earnings from Stores and Business Customers.

The average merchant will, among the items in which the charges against his gross sales are distributed, probably allow 1 per cent for heat and light, and 2 per cent for advertising.

Most merchants are easily convinced that it pays them to have their store well lighted, and it does not take much argument as a rule to convince a merchant that it is a good investment to have his windows lighted until 11 or 12 p. m. every night in the week, including Sundays and holidays. To go further than this and induce the merchant to increase his lighting appropriation, one of the best methods is to point out the advertising value of an unusually well lighted store or of some especially unique lighting feature, as of an electric sign or of outlining the front of the building in small candle power lamps.

Most merchants have a definite sum fixed, which they have decided is all that they can pay for lighting, but if they can be convinced that an electric sign or other electrical display has an advertising value, it is not difficult to get an increase in the amount for electric service.

Properly, electric window and sign lighting is chargeable to advertising, and this should be emphasized, that the percentage allowed for lighting purposes only, be not exceeded.

Very often a merchant has use for a small motor for saving labor in some part of his store, or he may need an electric heater for cashier's desk or office, and if we can sell electric service we get much more revenue than if we simply sell electric light.

Earnings from Ranch and Orchard Customers.

The rancher is sometimes the most difficult prospect to induce to use electric service, for the reason that he sells his crop and receives his year's revenue once a year while most contracts for electric service provide for monthly payments.

But nowhere else, is there such a field for the use of electric service as on the ranch. Pumping by electric power for irrigation can be made to show a large profit in increased crops and there are hundreds of other uses for an electric motor on a ranch, such as sawing wood, grinding feed, running cream separators and milking machines.

The average ranch owner works long hours and does a great deal of his work himself, partly to save expense, and partly on account of the uncertainty and unreliability of the average ranch help, and if we can convince a ranch owner that an electric motor will do certain ranch work better, quicker and cheaper than they can be done by hand labor, and save him not only the price of the labor, but the overseeing necessary to get the work done, it should be no trouble to sell him electric service.

The Saturation Point.

The saturation point of electric service will never be reached until every customer is supplied with every kind of electric service, which he can use at a profit, and afford to pay for.

Most customers are willing to more and more adopt the "electric way," and if they can be shown that an electric device will perform some service for them in a better, cheaper or more convenient manner at a price that is within their reach, they usually want it.

The customer wishes service and prefers electric service and if the customer's needs can be supplied, it is not hard to induce him to join the number of those who "Do It Electrically."

PETROLEUM AGAIN BREAKS RECORD.

The remarkably great output of petroleum during each year of this century was more than maintained in 1913. The amount produced in the past 12 months exceeded 240,000,000 barrels, or about 32,000,000 metric tons, according to estimates of David T. Day, of the United States Geological Survey. The production in 1912, which made the record up to that time, was 222,113,218 barrels. The rate of increase in 1913 was greater at the end of the year than at the beginning. California increased at least 10,000,000 barrels over 1912, almost reaching 100,000,000 barrels. The consumption in California almost equalled the production, and the addition to stocks was very slight. Oklahoma also showed a significant increase, with about 6 per cent addition to the stocks. Texas and Louisiana likewise increased their product. The output of the Gulf field declined, but this was more than offset by the increases in northern Louisiana and Texas. Wyoming showed a significant increase from the Salt Creek field. Other states generally showed a decline, which was greatest in lllinois.

The following is an estimate of the production in 1913, compared with the statistics for 1912:

Petroleum Production in 1913 (estimated) and 1912, in Barrels.

State.	1913.	1912.
California	98,000,000	86,450,767
Oklahoma	62,500,000	51,427,071
Illinois	22,000,000	28,601,308
Texas	14,000,000	11,735,057
Louisiana	12,000,000	9,263,139
West Virginia	11,000,000	12,128,962
Ohio	8,000,000	8,969,007
Pennsylvania	7,000,000	7,837,948
Wyoming	3,000,000	1,572,306
Kansas	2,000,000	1,592,796
Indiana	900,000	970,009
New York	800,000	874,128
Kentucky	500,000	484,368
Colorado	200,000	206,052
Other States	100,000	.....
Total	242,000,000	222,113,218

Melting points of refractory oxides, as determined by C. W. Kanolt, associate physicist of the U. S. Bureau of Standards shows magnesia (Mg 0) to be the most refractory with a melting point of 2800 degrees C. Lime (Ca 0) comes next at 2572 degrees C; alumina ($Al_2 0_3$) melts at 2050, and chromium oxide ($Cr_2 0_3$) at 1990 degrees C. A modified Arsem graphite resistance furnace operated in a vacuum was employed in the tests.

GENERAL PROGRESS REPORT OF JOINT COMMITTEE ON INDUCTIVE INTERFERENCE.

(This progress report is a resume of the work accomplished and the conclusions reached by this committee since the last progress report made which appeared in the October 4, 1913, issue of this journal.—The Editors.)

Since the last progress report the Joint Committee on Inductive Interference, authorized by the California State Railroad Commission, has given a great deal of consideration to the analysis of results obtained from the several parallels on which an investigation has been conducted, together with the preparation of a program of work to be carried out by the committee in the immediate future.

The parallels concerned in this study are described in the last progress report from the committee. The principal exposures are, briefly, two parallels, (20 miles and 8 miles), between the 57,000 volt 3-phase line of the Sierra & San Francisco Power Company and the main coast line toll lead of the Pacific Telephone & Telegraph Company between San Francisco and Los Angeles. In addition to the telephone lead, circuits of the Western Union Telegraph Company are paralleled by this line in portions of its length. The high tension line in question is supplied by auto-transformers at the Guadalupe substation and supplies 33,000 volt and 22,000 volt lines of the Coast Valleys Gas & Electric Company through auto-transformers at Salinas. South of Salinas, the above mentioned telephone lead is paralleled by the 33,000 volt line of the Coast Valleys Gas & Electric Company for a distance of 41 miles between Salinas and King City. The telegraph circuits of the Western Union Company are also exposed to this high tension line. In all cases the power and telephone lines are on opposite sides of a public highway. The Sierra & San Francisco Power Company operates with a grounded neutral. Tests were made under conditions of grounded and non-grounded neutral of the star-connected auto-transformers at Salinas. There are no grounds beyond Salinas in the 33,000 volt and 22,000 volt lines supplied by these transformers.

The mass of experimental data and the studies concerning these exposures are embodied in some 30 technical reports. Some of the general results and conclusions indicated by a study of these reports are as follows:

The fundamental, (60 cycle), wave of voltage or current is relatively of little importance in the production of noise in telephone circuits. It becomes of importance, however, if it gives rise to longitudinal voltages of sufficient magnitude to constitute a physical hazard, to interfere with the operation of grounded signalling devices or superimposed telegraph service, or to operate protective apparatus on the circuits.

The harmonics of the voltage and current waves are of chief interest as the cause of noise in telephone circuits, particularly the higher harmonics or those within the range of the voice frequencies.

The fundamental and lower harmonics are important as disturbing factors in telegraph circuits.

The above facts show clearly the great desirability, from the standpoint of inductive interference, of having wave forms of voltage and current in power circuits free from all harmonics. That such does not obtain in the present state of the art is a basic cause of the disturbance to communication circuits paralleled by power circuits. Further than this these facts emphasize the desirability that designers and manufacturers eliminate, as far as is practicable, these features of design favorable to distorted wave forms.

In order to facilitate the analysis of the inductive effects of a power circuit on parallel communication circuits, the voltages and currents of a 3-phase power system can be conveniently regarded as made up of components which exhibit distinct characteristics and treated separately. In any 3-phase system in which the three voltages between pairs of wires are equal in magnitude the voltage between any wire and ground can be considered to be the vector sum of two voltages which are called the balanced and the residual components respectively. The balanced components consist of three equal voltages between the three wires and ground, the vector sum of which is zero. The residual components consist of three equal voltages between wires and ground which are in phase with each other. The residual voltage of the system is defined as the vector sum of the voltages of the three conductors to ground. It is, therefore, three times the residual voltage of the individual conductors or three times the equivalent single-phase voltage of the three conductors in parallel with respect to the earth. The currents flowing in the three wires of a 3-phase circuit may be considered to be composed of three sets of currents, namely: (1) balanced components consisting of equal currents in each of the three line wires whose vector sum is zero. (2) a single-phase current flowing in a loop composed of two of the wires. (3) a residual current divided equally between the three wires and returning through the earth. Residual current is defined as the vector sum of the three-line currents. It is, therefore, the equivalent single-phase current flowing through the three-line conductors in parallel with the earth completing the circuit. Connections of current and potential transformers are arranged for measuring the residual current and residual voltage of power circuits under investigation.

For the purpose of clearness, it is convenient to classify induction phenomena as longitudinal or transverse referring to their manifestation on a metallic circuit. Longitudinal induced voltage refers to the voltage induced between the circuit and ground in the case of electrostatic induction and along the circuit between the two ends of the exposure in the case of electromagnetic induction. The transverse induced voltage of a circuit is the difference between the longitudinal induced voltages of the sides of the circuit. In the case of electrostatic induction this voltage acts between the two sides of the circuit and in the case of electromagnetic induction it acts around the metallic circuit.

It has been found in the case of the power lines investigated that the fundamental 5th, 7th and 11th harmonics are prominent in the balanced currents and voltages while the fundamental, 3rd, and 9th harmonics are prominent in the residual currents and voltages of the power system.

By a comparison of the prominent harmonics in

the currents and voltages of the power system with those of the induction in the telephone circuits it is evident that the longitudinal induction arises principally from the residual voltages and currents while the transverse induction shows principally the characteristics of the balanced voltages and currents together with some effect from the residual voltage and current.

The effect of the condition of the neutral of the auto-transformers at Salinas, grounded or non-grounded in so far as the induction from these exposures is concerned, is through the residual currents and voltages of the several high tension lines connected to these transformers. A representative value of the neutral current at Salinas during the tests conducted at that point is 0.3 ampere. It is composed almost entirely of 9th harmonic together with the fundamental and 3rd harmonics, decreasing in magnitude in the order named. The length of the power circuit between Guadalupe and Salinas is approximately a quarter wave length for the 9th harmonic. This fact may have some bearing upon its large magnitude and is to be further investigated by the committee. Under existing conditions with the power system in normal operation, grounding the neutral of the auto-transformers at Salinas does not greatly affect the induction in the exposures concerned. Two reasons may be given for this result: (1) the load balance on the power system is such that a relatively small amount of load current flows through the neutral, (2) as three high tension lines are connected together by the auto-transformers at Salinas, opening the neutral connection to ground of these transformers does not completely eliminate the path for the residual current of any one of the three lines, since it may then flow to earth through the admittance to ground of the other two lines. It is quite evident from these considerations that this case presents special conditions which make it impossible to draw general conclusions applicable to any other case. Further consideration of the effect of grounding this neutral will probably be undertaken by the committee with the idea of determining its effect under abnormal conditions.

The banks of star-connected auto-transformers at Guadalupe and Salinas substations are provided with closed delta secondary windings which supply power for local consumption. For test purposes the secondary delta of the transformers at Salinas was opened. A large increase in the residual voltage and residual current with a consequent large increase in the induction in parallel telephone and telegraph circuits resulted. In all cases this increase applied particularly to the 3d harmonic. If star-connected auto-transformers are used, this test indicates, therefore, that from an induction standpoint it is beneficial to provide such auto-transformers with secondary windings connected delta.

On the eight-mile exposure it was possible to measure separately under different conditions of the telephone circuits, the electromagnetic and electrostatic induction. For this exposure, also, computations of the magnitude of the induction, both electromagnetic and electrostatic, were carried out. In computations of electromagnetic induction, experience has indicated that the distances between wires and their images cannot be assumed to be twice the height of the wires above the ground. Special tests were carried out in order to determine the equivalent depth of the image conductors. The tests indicated this depth to be approximately 300 meters below the earth's surface. Due to the electrostatic shielding effect of neighboring objects it was found, also, that the computed electrostatic induction was greater than that actually observed, indicating that in effect the ground surface was brought nearer to the conductors. Electrostatic shielding of the circuits under test, by grounding other circuits on the telephone lead at one point, reduced the electrostatic induction, particularly the longitudinal induction.

The effect of typical terminal apparatus of a telephone circuit in reducing the amount of extraneous current reaching the telephone receiver was the subject of some investigation. These effects vary with the length of the line and character of the induction.

As a means of minimizing inductive interference, some study has been given to the proper relative transposition of power and telephone circuits. Some of the considerations involved in this study are given in the portion of this report dealing with the future work of the committee.

The field engineering staff of the committee is now located at Santa Cruz and is investigating the parallel between the 22,000 volt 3-phase line of the Coast Counties Gas & Electric Company and a toll lead of the Pacific Telephone & Telegraph Company. This parallel is between Santa Cruz and Watsonville and is approximately 17 miles in length, the two lines occupying opposite sides of the public highway. The system of the Coast Counties Gas & Electric Company is isolated from ground. The high tension line involved in this exposure may be taken out of service when occasion requires and used for experimental purposes.

The committee plans to conduct on this exposure a series of tests for the purpose of determining the effectiveness of several different systems of transpositions of the power and telephone circuits. In considering transposition systems for parallel power and telephone circuits account must be taken of the effect of such transpositions on the different types of induction arising from the different components of the voltages and currents of the power system. The longitudinal induction arising from balanced voltages and currents can be made as small as desired by the insertion of a sufficient number of properly located power circuit transpositions. The longitudinal induction arising from the residual voltage and current of the power circuit is unaffected by power circuit transpositions except in so far as the magnitude of the residual voltage and current is affected by such transpositions. Transpositions in a power circuit tend to equalize the capacities of the three-phases to ground and, hence, reduce any residual voltage which may be due to inequalities in the capacities of the three conductors to ground. Residual voltages and currents give the same inductive effects as a single-phase grounded circuit operating with the three power conductors in parallel. For this reason residual voltages and currents, though small in comparison with

the balanced voltages and currents, have proportionally a very large effect in producing longitudinal induction in nearby circuits. The longitudinal induction arising from either the balanced or residual voltages and currents is independent of the transpositions in the telephone circuits. The large inductive effects resulting from a relatively small residual voltage or current and the inability to reduce the longitudinal induction arising therefrom render highly desirable the elimination from the power system of such residual components of voltage and current. The transverse induction from residual currents and voltages can be reduced by transpositions in the telephone circuits which tend to equalize the induction into the two sides of the circuit by exposing each side equally to the effect of the power circuit. The transverse induction from balanced currents and voltages is affected by transpositions in both the power and telephone circuits.

The problem of designing transpositions to minimize the inductive interference between parallel power and telephone circuits is further complicated by the elaborate transposition system of the telephone circuits which is designed to reduce the induction or cross-talk between different telephone circuits. In order to be most effective in reducing inductive interference it is absolutely essential that the transpositions in the power and telephone circuits be located with due regard to each other.

By the experimental study of transposition systems being conducted at Santa Cruz, the committee hopes to be able to determine:

(a) The effect of power transpositions in reducing the longitudinal induction arising from halanced currents and voltages.

(b) The effect of telephone transpositions in reducing the transverse induction arising from:

1—Residual currents and voltages.

2—Balanced currents and voltages.

(c) The effect of power and telephone transpositions properly located with respect to each other in reducing both the longitudinal and transverse induction arising from balanced currents and voltages.

(d) The relative effectiveness of different transposition systems in reducing electrostatic and electromagnetic induction.

In its application to other exposures the infornation to be obtained from this experimental study will be chiefly of value in indicating the limits and refinements within which it is necessary to work and the accuracy with which the effectiveness of any proposed system of transpositions may be predetermined.

In addition to the study of the effect of transpositions the committee will undertake in the near future to determine the effect of known amounts of noise, (extraneous current), in the telephone receiver in reducing the intelligibility of conversation over a circuit. As the first step in this investigation, tests will be conducted to determine the detrimental effect of known amounts of single frequency extraneous current in reducing the intelligibility of conversation. This detrimental effect will be rated as the equivalent of an increase in the length of the circuit. From such tests with single frequency extraneous currents the relative detrimental effect of currents of different frequencies will be obtained. This, together with information as to the detrimental effect of currents of complex wave form, will give information by which the law of the combination of the single frequency effects can be obtained.

Until such time as the committee is prepared to make recommendations to the railroad commission it feels at liberty to indicate only in the most general way the results of its investigation. Since its formation, a year ago, the work of the committee has served to emphasize to all members the magnitude of the problem under investigation and the necessity of a thorough consideration of the subject in all its different phases, before the committee, in justice to itself and to the railroad commission of California can make final recommendation to that body for its action.

WISCONSIN COMMISSION TREATMENT OF MUNICIPAL PLANTS.

A public utility plant owned by a city should be treated as an enterprise separate and distinct from the city itself. All its accounts should be kept accordingly. In every respect the plant should be deemed an independent agency.

This is the conclusion of the railroad commission of Wisconsin in a recent case involving the rates of a municipally owned water utility. Wisconsin is one of the few states in which public utilities owned by municipalities are regulated by the state commission in exactly the same manner as privately owned public utilities. In this case the city of Sparta applied to the commission for authority to increase and readjust its water rates. The case was decided September 13, 1913, and is reported in 12 W. R. C. R., 532-547.

The commission states:

1. The city must pay the utility at a reasonable rate for all service rendered the city.

2. The utility must pay the city a reasonable amount as taxes and as interest on the city equity in the property of the utility.

3. The city must provide all funds for capital expenditures such as new extensions, retirement of bonds, etc.

Water damage to oil wells in the Coalinga field is being investigated by the California State Mining Bureau, which has issued a preliminary report. Flooding of oil sands by underground water is so serious as to threaten suspension of operations by several companies. An oil well commissioner is systematically gathering data and getting the co-operation of the operators in finding the cause of the trouble. In one well chemical corrosion of the well casing by "black sulphur water" admitted water which flooded six wells. Some wells have passed through oil sands which were not recognized as such; and these sands will be tested with the expectation of finding more oil than first calculations indicated. It has also definitely shown that water occupies the same sands that farther up their dip have produced oil, and that as the oil is removed the water gradually creeps upward along the stratum, making it necessary to shut off this particular bed to prevent its flooding the other sands which have not yet been drained of all their oil content. A noncorrosive casing, either painted or of a different metal, is suggested as a remedy.

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Safety First

The revolving of a myriad wheels of industry by that inexorable power made possible by the miracle of turning the waste of falling waters into the modern "juice" of comprehensive service; the consequent use of high voltage transmission; and that other miracle of rapid transportation which makes the seven league boots of childhood's wonderment fade into insignificance, are all fraught with the necessity for exercise of increasing vigilance that safety be assured.

This need for industrial safety in all departments has been crystallized into the slogan "Safety First," which together with the activities it involves, is being universally adopted as a badge of assurance by all those individuals and corporations whose employment is hazardous to life.

They who preach the certitude of protection afforded by the doctrine of safety are the apostles of prevention.

"Safety First" is the expression of an instinctive trait of self-preservation, though it also includes as a matter of development, the humanitarian viewpoint which places the safety of others before the self indulgence of apathy and carelessness.

"Safety First," movements usually commence with the employe, but it is equally certain, where the public are party to the activities of the corporation, that the effective education of that public is of equal importance if the number of accidents is to be reduced.

It is said that when railways were first introduced into Italy the peasants, whose simplicity and lack of education gave them no conception of the momentum of a great mass travelling at high velocity, were not infrequently run over. Although on matters so simple, general knowledge is in this country sufficient, there are still many matters upon which public education is needed. Forewarned is forearmed.

The education of the child as a primary precaution in the prevention of accidents will be always necessary.

Adults need to know the danger of the misuse or abuse of electricity and the necessity for taking precaution to protect themselves from possible accidents when travelling. Each and all must do their part, though the travelling man is a preferred "risk."

The closer contact and experiences of the employe, give him a better knowledge of deficiencies or conditions which might cause accidents, than the official higher-up has who would be held responsible should such accidents occur. With the detection of what is wrong comes almost invariably knowledge of that which should take its place. To this end, corporations and employers generally have sought the co-operation of their employes, who have been urged to report defective tools, machinery, cars, tracks and all other matters the remedying of which might prevent accidents.

It has been objected, on the ground that it meant "spying on fellow employes," that to direct attention to the non-use or mis-use of accident preventing methods and devices, could not be countenanced. On the other hand, a broader view of the matter shows the

interdependence of all and that as a matter of self preservation, as well as from the humanitarian viewpoint, such action is commendable and not contemptible as previously supposed.

An accident having occurred, "safety first" requires knowledge also of those methods by which life may be preserved, such as resuscitation from shock, first aid to the injured and so forth.

"Safety First" also calls for the use of all those mechanical devices which will minimize the hazard of employment. Then when all this has been done there has still to be reckoned the recklessness and daring bravery also of the human element which hopes that in some manner their rash act or indifferent will escape the consequence. But at some time the pitcher is taken to the well for the last time and nothing but broken fragments bear witness to a usefulness destroyed.

So the toll of deaths and the expense of accidents will never be entirely eliminated until individuals recognize their full responsibility, and safety first, last, and all the time, becomes instinctive.

Central Station Merchandising Methods

Some central stations endeavor to secure all the lamp business resulting from their operations. Campaigns are also carried on for the purpose of selling appliances. This merchandise is usually offered at cost, or at an increase in price which does not permit a fair profit for handling the business.

Lamps of poor quality resulting in poor lighting service was the excuse for the central station engaging in the distribution of lamps, but a product universally improved has removed that necessity.

This, together with the more general use of appliances is reason sufficient for the discontinuance by central stations of such sales. All dealers in goods electrical now carry stocks of approved appliances and these would undoubtedly be larger if more business were assured. There can be now no suspicion on the part of the central station that orders turned over by them to the contractor or electrical supply house will not be properly and promptly filled.

A central station can show interest in its customers by disseminating information among them regarding the scope, use and desirability of electric appliances; the proper method of installing and the economical use of electric lamps. Such educational work is a legitimate sales expense and where invention causes such rapid changes and the sale of product (energy) is practically perpetual, it should certainly become an important item in central station service.

The central station should create business for those concerns legitimately engaged in the sale of electric lamps and appliances, for such co-operative effort would give even greater returns.

Increased current consumption without any appreciable increase in investment is the principal advantage to the central station.

Public service commissions have gone on record as being in favor of regulated monopoly of public utilities, but as opposed to the principle of serving any customer at less than cost on the grounds that other customers have to bear the burden of loss. A fair return upon its investment is assured the utility.

But all consumers do not use lamps or those current consuming appliances sold by central stations, hence the further injustice of their selling these commodities at cost—or, in other words, at a loss.

Public service commissions should insist upon the discontinuance of such merchandising methods and in fixing prices at which these commodities shall be sold by central stations should consider the fact that a large part of the business of electrical supply houses is in these very things. If they permit a monopoly to secure business at cost or with a minimum amount of gross profit, to that extent they do an injustice to legitimate electrical supply houses.

Proper School Room Lighting

Due to careless planning of both daylight and artificial illumination of school rooms, the question, "Can you see the black-board from where you sit?" became a common expression among school teachers. It was not only common, but incorrect. They knew well enough that the board could be very well seen from any part of the room. The actual information desired was, whether or no all could see the chalked figures on the board—an entirely different matter.

These black-boards usually faced the windows and being smooth and sometimes polished with use, reflected specularly practically all the light falling on them, with the result that there was then no contrast between the white chalk marks and the "black" board. Consequently the marks could not be distinguished.

During the winter months and at night school conditions were not vastly different. Bare light sources, usually flickering, open flame gas burners, gave a very low intensity of illumination on the desks and did not mitigate the evil of glare.

This was emphasized considerably by the use of highly glazed paper for books and for writing purposes. Altogether, conditions were not conducive to efficient study.

Young people gave up their evening studies early because of headaches really resulting from bad lighting conditions though attributed to too prolonged study—working during the daytime and studying at night.

The difficulties attendant have been recognized and this is the first step toward their elimination.

Progress along this line has however been halting. While in some places it has received considerable attention and the best possible results secured, the great bulk of school room lighting is still inadequate, inefficient and obstructive.

A description of proven satisfactory school room lighting is given under Lighting Methods in this issue. It is by no means the only method but shows how this problem may be satisfactorily solved.

To the practicing illuminating engineer or lighting specialist this article has the added value of showing how this type of asymmetrical unit should be installed. To the uninitiated this is usually a serious stumbling block in planning this method of lighting. The data is well worth filing.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

E. J. Nally, president of the Marconi Wireless Company of America, is at San Francisco.

Joseph S. McKnight, agent for the Utah Power and Light Company at Vernal, is visiting in Salt Lake City.

T. M. Robinson, city engineer of Fresno, Cal., spent a few days at San Francisco the latter part of last week.

E. C. Estep, telephone specialist of the Western Electric Company, New York, was a visitor at San Francisco last week.

W. G. Higgins, superintendent of supplies, Western Union Company, New York, was at San Francisco during the past week.

A. E. Roome has been appointed general manager of the Pacific Electric Railway Company, vice H. L. Metcalf, deceased.

R. Clapp, former Jovian Statesman for Southern California, was a visitor at San Francisco from Los Angeles during the week.

A. Patzer of the Patzer Electrical Works at Stockton, California, spent a few days at San Francisco during the past week.

C. W. Whitney, Natomas Consolidated of California, attended the Industrial Safety Convention at the University of Nevada.

P. Sheedy, superintendent motive power, Southern Pacific Company, Los Angeles, was at San Francisco during the past week.

H. C. Hazzard, secretary, Pacific Coast Electric Railway way Association, was at San Francisco from Portland during the past week.

A. May of the San Diego Consolidated Gas & Electric Company, has been appointed Jovian Statesman for San Diego, California.

A. V. Olson, of Pass & Seymour, Inc., San Francisco, is taking a five weeks' business trip throughout the southern part of California.

T. T. Frith of Butte, Montana, was at San Francisco attending the convention of the Fire Underwriters' Association of the Pacific Coast.

Miles Steel, salesman, Benjamin Electric Manufacturing Company, is at Los Angeles on business and will spend some time in Southern California.

R. M. Alvord, A. V. Thompson and **A. G. Jones**, General Electric Company, San Francisco, attended the Industrial Safety Convention at the University of Nevada.

L. R. Elder of the Portland office, **E. C. Fellows** of Seattle, and **H. M. Hall** of the Los Angeles office, General Electric Company, were visitors at the San Francisco office during the past week.

Joseph S. Sands, salesman of the Westinghouse Electric and Manufacturing Company in their Denver office, is in Salt Lake City for a few days in connection with some special work for the company there.

A. D. Page, sales manager, Edison Lamp Works of General Electric Company, will attend the next meeting of the Pacific Coast Electrical Jobbers' Association to be held at Del Monte during March.

W. C. Orem, president Salt Lake and Utah Interurban Railroad Company, was at San Francisco last week inspecting the new gasoline motor cars being built for temporary use until completion of electrical equipment of his line.

C. H. Carter of the Pacific States Electric Company, Los Angeles, has left for the East, where he will attend the National Jobbers' Convention at Washington, D. C., and also visit the various manufacturers represented on the Pacific Coast.

Chas. N. Black, vice-president and general manager of the United Railroads, has left for New York to attend the semi-annual session of the executive board of the American Electric Railway Association of which Mr. Black is president.

R. T. Kahn, until recently connected with the lamp department of General Electric Company, San Francisco, will be one of the city salesmen with Holabird-Reynolds Company, vice **W. Tardiff**, who has been transferred to the new Oakland Branch.

T. H. Macdonell is now president of the California Electric Construction Company, vice **R. L. Wolden**, who will now engage in an electrical brokerage business at room 4, 641 Mission street. **C. L. Chamberlin**, for some years past connected with the company, will be manager.

C. W. Hutton, Pacific Coast agent of the General Vehicle Company, made Salt Lake City this week on his regular trip over the Northwest territory. He reports increased interest all through the territory in the electric vehicle as a result of the many installations which are giving satisfaction.

R. L. McBride, associate chemist for the Bureau of Standards at Washington, D. C., is making a study of gas conditions in California with particular reference to arriving at a proper standard for heating value in Oregon. Mr. McBride spent the past week in San Francisco and will return to Washington by way of Los Angeles.

Frank B. Whipple has been appointed vice-president of the San Francisco-Oakland Terminal Railways, succeeding **J. K. Moffitt**; **A. W. McLimont** has been appointed general manager; **Robt. Morrison Jr.**, secretary, and **Kirke Lathrop**, treasurer. **W. R. Alberger**, who was general manager, remains as vice-president of the company, and **F. W. Frost**, who resigned from the position of secretary-treasurer, will remain with the company in an advisory capacity.

Raymond E. Dresser, commercial engineer, power division, Utah Power and Light Company, has been appointed division manager of Southern Idaho, with headquarters at Montpelier, Idaho. Mr. Dresser is a graduate of the University of Utah, and completed the apprenticeship course in the Westinghouse works. After returning to Salt Lake City, he occupied various positions in the commercial department of the Utah Light and Railway Company, until a year and a half ago, when he entered the service of the Utah Power and Light Company.

W. H. Bancroft, president Utah Light and Railway Company, vice-president and general manager of the Oregon Short Line Railroad Company, and vice-president of the Salt Lake Route, has been relieved from his duties as general manager of the Oregon Short Line, at his own request. He will still continue as president of the Utah Light and Railway Company and vice-president of the Salt Lake Route. Mr. Bancroft is seventy-four years of age, and has been eligible for retirement for the last ten years, but has preferred to stay in harness until the present time, when he felt that in justice to himself he should relinquish a part of the arduous duties which he has carried for the past several years. Mr. Bancroft entered the railroad service in 1856 as telegraph operator and ticket clerk for the Michigan Southern Railroad, and has been continually in that service to the present time, rising through the various grades to the executive head of all of the Harriman interests in the intermountain territory. When the Harriman interests acquired control of the Utah Light and Railway Company in November, 1906, Mr. Bancroft was appointed president, and immediately entered upon the difficult task of reconstructing the system which had been allowed to depreciate until the physical value of its property was almost nil. During the past seven years, $7,000,000 have been expended on the system under his personal direction, and today Salt Lake City can boast of a street

railway and electric light and power system second to none in the country. The relinquishment of his duties as general manager of the Short Line will give Mr. Bancroft more time to devote to the details and management of the Utah Light and Railway Company, in which he has always been greatly interested.

OBITUARY.

W. P. Monahan, an engineer, graduate of the Boston Technical College, and for two years in the employ of the Stone & Webster Construction Company, was drowned on the 25th of January, 1914, while attempting on a horse to ford a creek near Webstone, in the Sierra Nevadas, thirty-six miles from Fresno, Cal. Mr. Monahan had been complaining of illness and started from the mountain construction camp to Fresno. His body was found the following day in Jose creek.

MEETING NOTICES.

The Jovian Electrical League of Southern California.

At the regular meeting at Christopher's on Wednesday, January 21st, G. E. Arbogast was the chairman of the day. There was an attendance of about 125 members and visitors. A. F. Rosenheim, F. A. I. A., gave a very interesting address on "The Architect," and urged very strongly the necessity for concerted action in securing a civic center in Los Angeles, with proper architectural harmony.

1914 Convention Illuminating Engineering Society.

At the last executive meeting of this society it was arranged to hold the eighth annual convention at Cleveland, Ohio, during September of this year. Clevelandites are very enthusiastic over the arrangement and expect to make the 1914 Cleveland Convention memorable as the best ever held by the Society.

The ninth convention in 1915 will be held at ——— (wake up, San Francisco, 1915.)

Organization Dinner International Electrical Congress.

An organization dinner for the discussion of plans for the International Electrical Congress at San Francisco in September, 1915, is to be held at the Engineers' Club, New York City, Tuesday evening, February 24th. Invitations will be issued to members of the Congress General Committee of 150, to members of committees of the American Institute of Electrical Engineers and officers of the Institute and its sections.

San Francisco Electrical Development and Jovian League.

On Tuesday, January 27, 1914, the after luncheon talk at Tait's was given by W. L. Goodwin, on the subject of "Salesmanship." The subject and the speaker drew a large attendance and additional tables were requisitioned. The paper, which was divided into two parts, first dealt with an analysis of salesmanship and the development of salesmen as applied to the electrical supply business, and second, with nifty lessons on salesmanship, or getting the order by the "Do and Don't Route." It was both helpful and inspirational and was well received by the many members present. Mr. W. F. Neiman was chairman.

Seattle Jovian League.

The members of the Jovian Order met Friday, January 23d, at the Rathskeller Cafe with about seventy-five members present. The feature of the after lunch talk was a few words by Mr. J. D. Ross, superintendent of the city light plant. Mr. Ross dwelt particularly on the progress of the municipal light business and stated that 4½ per cent of the current now used in the city of Seattle was furnished by the city plant, and since its conception rates have been gradually reduced in the city until at this time for residences we have a six cent light rate and a three cent heating rate.

Utah Electric Club.

At the regular meeting of the Utah Electric Club in the gold room of the Commercial Club, Thursday, January 22nd, at 12:30, J. C. Jones, chairman, presided. H. S. Sands of Denver outlined plans for the consolidation of the Colorado Electric Club with the Traffic Club of Denver. The new club will be known as "The Electric and Commercial Club," and the former members of each will have the full privileges of the commodious quarters of the Chamber of Commerce Building on Champa street.

The regular speaker of the day was W. S. McCarthy, traffic manager of the Salt Lake Hardware Company, and secretary of the Commercial Club Traffic Bureau of Salt Lake City. He spoke on the subject "Recent Rulings of the Interstate Commerce Commission Affecting Intermountain Traffic." He outlined the work of the Traffic Bureau, leading up to the ruling of the Interstate Commerce Commission about a year and a half ago, effecting a reduction of 15 per cent in glass rates and 35 per cent commodity rates to intermountain points, and indicated some of the adjustments which were still necessary to equalize some of the traffic conditions now existing.

Engineering Meeting at University of Idaho.

On Saturday, January 17, the Spokane Section of the A. I. E. E., the Spokane Chapter of the A. S. C. E., and the Columbia Section of the A. I. M. E. held a joint meeting with the Faculties of Engineering and Engineering Students of the University of Idaho and the Washington State College at Moscow, Idaho. This was in the nature of a "get together" meeting, for the purpose of allowing the practicing engineers to get in touch with engineering education in this section, and to enable the students to get in touch with engineers who have left their college days behind them, and become seasoned to the practical work of life.

At 3:30 the afternoon session commenced in the University auditorium. Mr. L. K. Armstrong of Spokane, (A. I. M. E.) presided. A paper was presented by Mr. J. C. Ralston of Spokane (A. S. C. E.) upon the factors involved in the preparation of an estimate for a municipal hydroelectric plant for a city of 125,000 inhabitants. This was discussed by Mr. C. S. MacCalla, general manager of the Washington Water Power Company, by Mr. Morton McCartney, city engineer of Spokane, by Mr. J. E. Moody of the firm of Hurley-Mason Company, contractors. Mr. Ralston's paper touched not only upon the various features of an ordinary project, but the added influence of politics, city wage scales, bonds, etc., upon the cost. Mr. MacCalla spoke of the extreme difficulty experienced in getting definite information before commencing work, not on what the project "ought to cost" but in what it will cost, which is the feature which affects the public or the stockholder. Mr. McCartney emphasized the division demarcation of the paper into technical, political, financial, and economic features. Mr. Moody touched upon the difficulties of the contractor in interpreting or following contradictory clauses in specifications, and the injustice of so many corporations, in their specifications, in refusing to guarantee the work of their engineers, but making the contractor take the responsibility. Members of the faculties of both institutions joined in the discussion, calling attention to the fact that the technical was one part only of the engineer's work, and that there are other talents to be developed before success in engineering is possible.

Mr. F. A. Ross then presented a paper descriptive of the Wood system of Surface Tension Flotation which was discussed by members of the A. I. M. E. present. Prof. R. S. McCaffery was asked to tell something of his investigations on the electrothermic separation of lead and zinc ores at the University of Idaho. He outlined in a few minutes the results aimed at, but stated that sufficient progress had not been made as yet to render definite conclusions possible.

At 5:30 the meeting adjourned to the dining room of Ridenbaugh Hall where a trencher test was conducted by the Engineering Faculty of the University to the complete satisfaction of all concerned so far as known.

At 7:30 the engineers returned to the Auditorium where they listened to an illustrated paper on the Little Falls Tie Line by Mr. J. B. Fisken, superintendent of light and power for the Washington Water Power Company. The time being late, discussion was cut short, and the visitors repaired to their respective trains. It is hoped that more meetings of this nature will be held in the future, alternating between the Washington State College and the University of Idaho.

DOING IT ELECTRICALLY AT ABERDEEN, WASH.

Tuesday, January 13th, was suddenly turned into a holiday for those engaged in the electrical industry in Aberdeen, Wash., when it was discovered that nine traveling salesmen, representing as many different electrical jobbing houses and manufacturers had arrived in town during the morning and evening before, each without knowing that he would meet any competition in the field.

There are three electrical concerns in Aberdeen, The Grays Harbor Railway & Light Company, The Electric Service & Supply Company, and The Aberdeen Electric Company. All the available business was corralled and the balance of the day was utilized in educating candy store clerks, tenders of soda fountains, and so forth, to "Do It Electrically."

In the evening the boys banqueted at the Hotel Washington, after which J. C. Bird, the man with the Paderwiski Movement, manipulated the ivories, while Jack Landerkin



Raincoats Prove That Aberdeen Is Not "Dry."

rendered several ballads for the entertainment of the guests, (some of them were still there when he finished.)

The picture herewith was taken by the writer (W. S. Mendenhall, sales manager The Electric Service & Supply Company), in front of the Electric Building. It shows eight of them, Frank J. Zorn could not be located and we all had a strong suspicion that he was out trying to impress some Mill-Man with that "Guarantee of Excellence," which he always carries on his shoulder like a chip. From left to right they are: H. R. Miller of the Northwestern Supply Company, Seattle; C. A. Norton of the Westinghouse Electric & Manufacturing Company, Seattle; W. N. Landerkin of the Pacific States Electric Company, Seattle; M. H. Nichols of the Western Electric Company, Seattle; W. B. Thomas of North Coast Electric Company, Seattle; J. W. Leighton of the Every-Ready Dry Battery Company, Portland; J. M. Chamberlain of Fobes Supply Company, Portland; J. C. Bird of Westinghouse Lamp Company, Seattle.

The boys all wished a copy of the picture forwarded to the Journal and no doubt they will be recognized by their many friends throughout the coast territory.

PACIFIC COAST MEMBERS SOCIETY FOR ELECTRICAL DEVELOPMENT.

That considerable interest has been aroused in this Society is evidenced by the splendid representative membership of Pacific Coast firms as given below. It should be noticed that national companies with Pacific Coast offices are not included and only one office is given for local companies maintaining offices in several cities.

Albany Elec. Supply Company, Albany, Ore., J.
Burkhart Elec. Works, Palo Alto, Cal., C.
Capital Electric Company, Salt Lake City, Utah, J.
Comet Electric Company, Eugene, Ore., C.
Electric Appliance Company, San Francisco, Cal., J.
Electric Corporation, Los Angeles, Cal., J.
Electric Lighting Supply Company, Los Angeles, Cal., J.
Electric Shop, Riverside, Cal., C.
Flagstaff Elec. Light Company, Flagstaff, Ariz., CS.
Fobes Supply Company, Portland, Ore., J.
Fyhn Electric Company, Brigham City, Utah, C.
Gilson Elec. Supply Company, Oakland, Cal., J.
Glendale Elec. Light Dept., Glendale, Cal., CS.
Grays Harbor Ry. & Light Company, Aberdeen, Wash., CS.
Green, C. F., San Pedro, Cal., C.
Haller-Cunningham Elec. Co., San Francisco, Cal., C.
Hanbridge, W. S., San Francisco, Cal., C.
Hillman Electric Company, No. Yakima, Wash., J.
Holabird-Reynolds Elec. Company, Los Angeles, Cal., J.
Hunt, J. A., Pleasanton, Cal., C.
Independent Elec. Company, Twin Falls, Idaho, J.
Inter Mountain Elec. Co., Salt Lake City, Utah, J.
Jacobs Electric Company, S. Pasadena, Cal., C.
Journal of Electricity, Power and Gas, San Franisco, Mis.
Kirkpatrick, James Q., Los Angeles, Cal., M.
Knight & Company, E. L., Portland, Ore., C.
Kohlwey Light Company, W. D., San Francisco, Cal., C.
Levy Electric Company, San Francisco, Cal., C.
Lockwood, C. M., Salem, Ore., C.
Montana Electric Company, Butte, Mont., J.
Mullins Electric Company, Wm. A., Taacoma, Wash., C.
North Coast Electric Company, Seattle, Wash., J.
Pacific States Electric Company, San Francisco, Cal., J.
Paine-Bailey & Company, San Francisco, Cal., C.
Panama Electric Lamp Company, San Francisco, Cal., J.
Paul, B. W., Portland, Cal., C.
Pierce Tomlinson Elec. Co., Portland, Ore., C.
Pomeroy, J. G., Los Angeles, Cal., C.
Pope, Harry D., Boise, Idaho, C.
Richmond Elec. Company, Richmond, Cal., C.
Rockwell-White Power & Light Company, Bellevue, Idaho, CS.
Russell Elec. & Machine Company, Tucson, Ariz., C.
Santa Paula Elec. Works, Santa Paula, Cal., C.
Sheridan County Electric Company, Sheridan, Wyoming.
Silver City Power Company, Silver City, New Mexico, CS.
Tillamook Elec. Light & Fuel Company, Tillamook, Ore. CS.
Truckee River General Electric Company, Reno, Nev., CS.
Tucson Gas, Elec. Light & Power Company, Tucson, Ariz., CS.
Vandegrift, J. A., Oakland, Cal., M.
Walsh Company, M. J., Portland, Ore. J.
Wenatchee Valley Gas & Elec Co., Wenatchee, Wash., CS.
Western Transformer Company, Oakland, Cal., C.
Wilson, J. E., Los Angeles, Cal., J.
Woodill & Hulse Electric Company, Los Angeles, Cal., J.

INLAND WATERWAYS ASSOCIATION OF CALIFORNIA.

This association is carrying on an active membership campaign which includes also an appeal for funds to carry out the purposes for which it was formed—"The furtherance of navigation by means of inland waterways, and the investigation, co-operation, and promotion of navigation, water storage, flood water control, irrigation, drainage, reclamation and kindred subjects, all being related or incidental to the primary purpose of inland waterways, navigation. The officers are: Wm. R. Wheeler, president; Chester H. Rowell, first vice-president; Mrs. E. G. Greene, Stanford University, second vice president; J. L. Craig, treasurer; and David H. Walker. San Francisco, executive secretary.

INTERNATIONAL ELECTRICAL CONGRESS.

The executive committee of the International Electrical Congress to be held at the Panama-Pacific International Exposition in September, 1915, has fixed the price of membership in the Congress at $5, entitling the member to one general volume and four section volumes, paper bound; with the additional volumes at the rate of $1 each, and $10 for the entire set of thirteen volumes. These prices are for paper bound copies. For books bound in cloth an additional charge of 50c per volume will be made. To this is to be added a fee of $1 per member to cover the bare cost of shipment. An organization dinner is to be held at the Engineers' Club in New York City on February 24th, when John A. Britton of San Francisco is expected to address the meeting.

INDUSTRIAL

STANDARD SIZES OF CONDUIT.

Recognizing the necessity and desirability of accurate data in reference to the proper size of conduit to be used in the installation of wires and cables, the National Electrical Contractors' Association has prepared a set of six charts showing this information in detail and in full size.

The disposition in the past has been to use conduits of too small interior diameter, and in the preparation of these charts care has been taken to recommend conduits of sufficient size to cover all working conditions, and at the same time having in mind that economy in installations should be considered and extravagant sizes in conduits not recommended. It is felt that the sizes recommended are sufficiently large and at the same time conservatively calculated.

The charts were prepared after long and careful study of the actual conditions encountered in making installations, and they have been officially adopted by the National Electrical Contractors' Association as a standard.

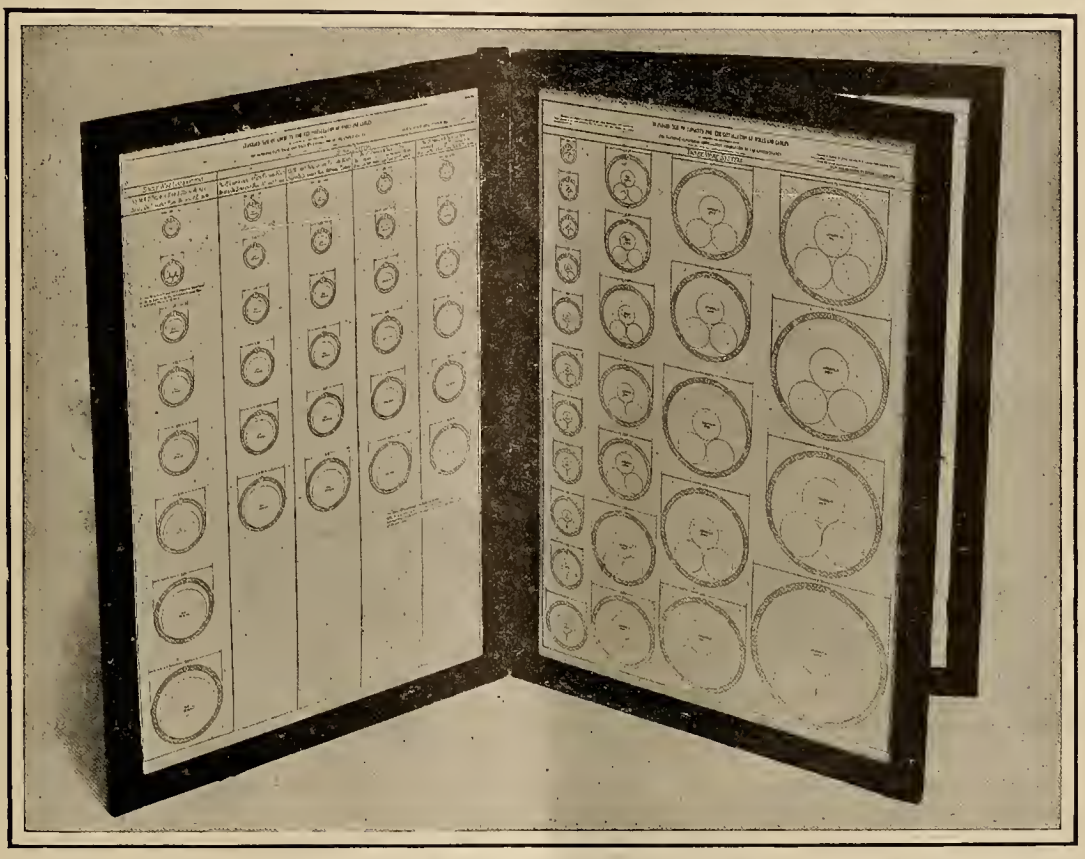
They show the conduit and conductors full size so that you have the actual condition before you, and the form of the chart is shown by the cut on page two which is reduced somewhat over two-thirds in size. The prints are made from plates so that there can be no variation from the actual size.

In addition to showing the size of the conduit needed for each combination of wires, the chart also gives the actual external diameter of the conduit and the carrying capacity of the wires used in accordance with the changes made in the National Code this year.

This covers practically all the data required for any installation of wires in conduit and presents it in a form most convenient for use.

The advantage of a standard system is self evident from the standpoint of the architect, engineer and contractor, and it is the hope of the National Electrical Contractors' Association that those having to do with the installation of conduits will accept the charts as prepared, and write into their specifications that "all sizes of all conduits shall be the N. E. C. A. standard.

The charts are substantially framed in wooden frames hinged together and provided with a backing board for convenient hanging. There will be three in the complete set, two charts being mounted on each sheet, and each chart is marked with the name of the system shown on the reverse side.



Conduit Charts Showing Their Arrangement for Easy Reference.

The National Electrical Contractors' Association has borne the work and expense of the preparation of these charts and in the interest of standardization is prepared to furnish the sets at the actual cost of producing them.

TRADE NOTES.

The Oregon Electrical Contractors' Association has issued a price and reference sheet for distribution among architects and electrical contractors. This price book in addition to prices has a large amount of valuable data and trade information. A copy of this book may be obtained free upon application to F. C. Green, secretary, 291 E. Morrison street, Portland, Ore.

T. R. Cornick has secured the contract for building "forty-three miles of 44,000 volt wooden pole transmission line for the city of Kamloops, B. C." DuCane, Dutcher & Company of Vancouver are the engineers handling this work for Kamloops; they are also in charge of the building of the power house, substations and auxiliary steam plant. This work will start in the early spring.

NEWS NOTES

FINANCIAL.

SAN FRANCISCO, CAL.—Treasurer McDougald has disposed of the last of the $653,000 of 5 per cent Municipal Railway bonds which had been turned over to him by the supervisors, all of them being sold at a sufficient premium to make the net interest upon the purchasers' investment 4.90 per cent.

SEATTLE, WASH.—The Puget Sound Traction, Light & Power Company report for the year ended December 31 shows: Gross earnings, $8,613,599, an increase of $299,751; net earnings, after taxes were paid, $3,605,224, an increase of $63,675; balance, after charges were paid, $1,793,188, an increase of $4615; bond sinking fund, $251,583, an increase of $27,709; surplus, $1,542,205, a decrease of $23,094.

SANTA ROSA, CAL.—The California Telephone & Light Company has reported to N. W. Halsey & Company for the year 1913 as follows:

	1913.	1912.	Increase.
Gross earnings	$105,679	$90,485	$15,193
Operating expenses, maintenance and taxes	59,804	50,375	9,429
Net income	45,874	40,110	5,764
Interest	21,000	21,000	.....
Balance	24,874	19,110	5,764

The satisfactory increase in the company's revenue is significant of the activities during 1913 in the development and extension of the consumption of the electricity in its territory. While telephone revenue and miscellaneous revenue showed normal increases, the greatest increase was in the electric operations, amounting to 22 per cent increase over the gross revenue from this source during the year 1912. The cost of obtaining new business in 1913 is also reported, it being an initial expense which will not recur in subsequent statements in which the increase in earnings from this new business will appear greater than the proportion of increase in expenses. At present the annual interest on the company's bonded debt is earned more than double.

INCORPORATIONS.

SANTA ANA, CAL.—Articles of incorporation have been filed by the Valencia Water Company, with principal place of business at Orange, Cal.

CUCAMONGA, CAL.—Alta Loma Water Company has been incorporated and has taken over the well on S. Johnson's place. About 7000 ft. of 5 in. pipe will be purchased and laid by the company before beginning of the irrigating season.

ILLUMINATION.

AMUSVILLE, ORE.—The electric light franchise up before the city council for the last two months, has been granted to the Amusville Flour Mills of this place.

VAN NUYS, CAL.—The contract for installing an ornamental lighting system at Ocean Park has been let to J. A. Bailey of Van Nuys. The electroliers will be of the 5-cluster type.

SAN BERNARDINO, CAL.—Plans for doubling the capacity of the electric plant of the Southern Sierras Power Company at Barstow at once, and the extension of distributing system to cover the entire city, are announced by W. M. Brison, district manager.

SAN RAFAEL, CAL.—Sealed bids will be received until February 2 for the erection of the concrete bases of 97 electrolier posts along Fourth street and the installation of an underground conduit system in three circuits for supplying electric current to 97 five-light electroliers.

WALLOWA, ORE.—With a view to the establishment of a municipal electric light plant, the city council has employed L. A. Reinaman, a civil engineer at Freewater, to make a survey and estimate the cost of the project, it being understood that the survey will be made as soon as weather conditions will permit.

EVERETT, WASH.—A reduction of 20 per cent in the price of electricity used in Everett's homes is announced by Manager D. C. Barnes of the Everett Railway, Light & Water Company, effective April 1. The charge now made by the company runs from 11 cents per kw.-hr. down to 8 cents, depending on amount of current used.

SEATTLE, WASH.—Effective February 1 and affecting rural and suburban districts near the lines of this company, and applying to all bills for service for both old and new subscribers to the electric light and power current of the Puget Sound Traction, Light & Power Company, during the month of February. The maximum rate of 10 cents per kw.-hr. on the date named will be reduced to 8 cents per kw.-hr.

RUPERT, IDAHO.—The heating of the new high school by electricity is the first case on record where large buildings have been heated entirely by such means, announces the Federal Bureau of Education at Washington. Besides being used for heating, the electricity, which is generated from a government power house, is utilized everywhere in the building. A ten horsepower motor, besides driving the ventilating fan, supplies the power needed for the lathes and saws in the manual training department. An electric heater supplies the hot water for the domestic science department, for the shower bath and for the science rooms. The bureau says that the use of electricity is proving a real economy.

TRANSMISSION.

VANCOUVER, WASH.—The power plant of the Washington-Oregon Corporation on the Kalama River was burned recently. The plant developed 2000 h.p.

LEBANON, ORE.—Scroggings & Washburn, owners of the Lebanon Lumber Mill, have applied for a franchise for the erection and maintenance of an electric light and power plant within the city limits.

KLAMATH FALLS, ORE.—The council instructed the city engineer to make a valuation of the old Ankeny ditch, owned by the government, as a step toward the construction of a municipal light and power plant.

SAN FRANCISCO, CAL.—The Secretary of Agriculture has granted during the past week rights of way for power transmission lines through National forests in California to the Pitt River Power Company, and the Pacific Light & Power Corporation. The Pitt River Company's right of way is for a power line approximately five miles long on the Shasta National Forest. The company applied under the act of March 4, 1911. In this case the grant was made upon the Forester's recommendation for the full 50 year period.

BOISE, IDAHO.—Thirty million dollars in bonds is involved in a suit to foreclose a mortgage which has been filed in the Federal Court here by the Guaranty Trust Company of New York against the Idaho Railway, Light & Power Company, the Idaho Traction Company, the Westinghouse Electric & Manufacturing Company and E. H. Jennings. The Westinghouse company filed at the same time a petition praying for permission to file a bill to foreclose a mortgage held by that concern against the property of the Idaho Railway, Light & Power Company for $40,761 for material alleged to have been furnished. The mortgages cover as well real estate in Silver City, the Tip Top mining property,

the Beaver River Power Company and their respective holdCaldwell extension of the interurban line, the Caldwell Power Company's plant, the Idaho-Oregon Light & Power Company's holdings, the Idaho Power & Light Company, formerly the Beaver River Power Company and their respective holdings.

SAN FRANCISCO, CAL.—With regard to the merger of the Northern California Power Company and the Oro Electric Corporation, H. H. Noble, president of the former company, issued the following statement: "Negotiations looking to the consolidation of the Northern California Power Company, Consolidated, and the Oro Electric Corporation, have reached the point where it can be definitely stated that this will be brought about through the agency of a new corporation, to be formed to take over the two companies in question. This amalgamation will be very advantageous to both companies as the Northern California Power Company, Consolidated, at the present time has a large surplus of power and the Oro Electric Corporation is now purchasing power from other companies, and has already contracted for a large amount of power to be connected up this spring. The consolidation will be advantageous from other points, as there can be a great saving in the operating expenses over those of the present. The dredging properties of the Oro Electric Corporation have not been included in the consolidation."

TRANSPORTATION.

PORTLAND, ORE.—Senator Jones has introduced a bill granting the Washington-Oregon corporation the right for an electric railroad, telegraph, telephone and electric transmission lines across the Vancouver military reservation

HEALDSBURG, CAL.—A. D. Bowen, the contractor and builder of the Petaluma and Santa Rosa electric line, is promoting a project for a trio of electric lines radiating from this city to Dry Creek Valley, Alexander Valley and down the Russian River.

RED LODGE, MONT.—A. J. Showalter, agent for the Red Lodge Electric Railway Company, who is promoting the sale of stock for the building of the trolley line from Red Lodge to Washoe and Bearcreek, has returned to this city and has reopened the campaign.

SAN FRANCISCO. CAL.—The stockholders of the Presidio & Ferries Railroad Company held their annual meeting and re-elected the entire board of directors. A resolution was passed to apply to the court to dissolve the corporation, as the road has been purchased by the city.

FRESNO, CAL.—Coupled with the announcement made by General Manager Webster of the Fresno Traction Company that six new center entrance electric cars would arrive in the city within a month was the statement that eventually the pay-as-you-enter system would be installed on all of the lines.

SAN FRANCISCO, CAL.—Engineers for the Crocker Estate Company are engaged in laying out an electric railroad tapping the holdings of the company in the South Hill district of San Francisco. The engineering work and a large percentage of the grading is practically completed. Approximately 1200 acres of the company's holdings will be made accessible for homesites with the inauguration of the line.

ALAMOGORDO, N. M.—In response to a communication from the Business Men's Association of Cloudcroft, asking for the support of the Commercial Club of Alamogordo in a movement towards securing the proposed electric line from Cloudcroft to Artesia, A. B. Carroll of St. Louis and associates are going over the proposed route securing the necessary statistics upon which to base a proposition for the construction of the line.

SAN JOSE, CAL.—The State Railroad Commission has extended the time in which the San Jose railroads shall reconstruct as a broad gauge line its present narrow gauge system from San Jose to King's Road, and then to Linda Vista, to connect with the line to Alum Rock. The company is given until August of this year to construct the standard gauge line from Twenty-sixth street to King's Road, and until February of next year to reconstruct its line from King's Road to Linda Vista.

SEATTLE, WASH.—The utilities committee of the council has recommended for passage a bill transferring $75,000 from the garbage fund to the city railway fund as a temporary loan. The amount will be used to pay for completing division "A" of the municipal street railway line. A bill transferring $23,500 from the general fund to the water fund to pay for water used by the city for October, November and December of last year, was recommended for passage. Both these bills now go to the finance committee for consideration.

TELEPHONE AND TELEGRAPH.

VENICE, CAL.—The Pacific Telephone & Telegraph Company has been granted a franchise in this city.

HILO, T. H.—Directors of the Hawaii Telephone Company have decided to spend $40,000 on improvements of the service on this island.

ELY, NEV.—A rural telephone system to connect all parts of the county with Ely is being agitated, and the residents are hoping to have work on the same start in the spring.

ALAMEDA, CAL.—After six months of deliberation, the public utilities committee of the city council has recommended that the Pacific Telephone & Telegraph Company be granted a franchise for 20 years.

OAKLAND, CAL.—Plans are being prepared for a 3-story and basement class A telephone exchange to cost $34,000 in Foothill boulevard west of Thirty-fifth avenue, for the Pacific Telephone & Telegraph Company by the department architect in San Francisco.

SANTA BARBARA, CAL.—The railroad commission has granted authority to the Home Telephone & Telegraph Company of Santa Barbara county to issue promissory notes in the sum of $15,000 and to pledge its bonds in the sum of $27,000 as collateral security therefor.

SAN DIEGO, CAL.—Lieutenant Commander G. C. Sweet, U. S. N., Washington, who has arrived in San Diego for the purpose of making an inspection of the Point Loma wireless station, states that work will probably begin within a month on the new $250,000 government station to be located near San Diego.

SEATTLE, WASH.—New long distance telephone toll rates have been put into effect by the Pacific Telephone & Telegraph Company, effective over all lines owned by this company. The new rates are based on the "air line" theory and will result in reductions in many cases and increased rates in others. Heretofore the long distance rates within the state have been based on a county system, with the result that in cases of towns a few miles apart but in different counties tolls have been unjust. It is the contention of the telephone company that under the new system of charges such injustices as this will be eliminated. In a letter of notification addressed to company managers in this state F. L. McNally, district commercial superintendent, states that more rates have been reduced than increased.

WATERWORKS.

ST. PAUL, ORE.—At a meeting of the city council a committee was appointed to investigate the advisability of putting in a plant to supply the city with water.

AZUSA, CAL.—The city council has instructed the city engineer to proceed with plans for calling a bond election; total, $50,000 to be voted on; $30,000 for water and $20,000 for light improvements.

ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page opposite

A-1 American Ever-Ready Co.
Los Angeles; 755 Folsom Street, San Francisco; Seattle.

B-1 Benjamin Electric Manufacturing Co.
Rialto Building, San Francisco.

B-2 Berkeley Electric Cooker Co.
1932 Center Street, Berkeley.

B-3 Blake Signal and Manufacturing Co.
680 Howard Street, San Francisco.

B-5 Bridgeport Brass Co. 4
(See Pierson, Roeding & Co.)

C-1 Century Electric Co. 3
614 So. Grand Ave., Los Angeles; Salt Lake City; 56 Natoma Street, San Francisco; Seattle; Spokane.

C-2 Crocker-Wheeler Co. 13
Title Insurance Bldg., Los Angeles; Salt Lake City; First National Bank Bldg., San Francisco; Seattle.

C-3 Cutler-Hammer Manufacturing Co. 15
579 Howard Street, San Francisco.

D-1 D. & W. Fuse Co.
(All Jobbers.)

D-2 Dearborn Drug and Chemical Works 13
355 East Second Street, Los Angeles; 301 Front Street, San Francisco.

E-1 Edison Lamp Works of General Electric Co. 11
(See General Electric Company.)

E-2 Edison Storage Battery Supply Co. 3
441 Golden Gate Avenue, San Francisco.

E-3 Electric Agencies Co.
247 Minna Street, San Francisco.

E-4 Electric Storage Battery Co.
Pacific Electric Building, Los Angeles; Spalding Building, Portland; 118 New Montgomery Street, San Francisco; Colman Building, Seattle; Pacific Building, Vancouver.

F-1 Fairbanks, Morse & Co.
Los Angeles; Portland; 651 Mission Street, San Francisco; Seattle; Spokane.

F-2 Fort Wayne Electric Works of G. E. Co.
Rialto Building, San Francisco; Colman Building, Seattle.

G-1 General Electric Co. 14
124 W. Fourth Street, Los Angeles; Worcester Building, Portland; Rialto Building, San Francisco; Colman Building, Seattle; Paulsen Building, Spokane.

H-1 Habirshaw Wire Co.
(See Western Electric Company.)

H-2 Hemingray Glass Co. 13
330 So. L. A. Street, Los Angeles; 345 Oak Street, Portland; 807 Mission Street, San Francisco.

H-3 Hoagland-Hulse Electric Co.
1707 Naud Street, Los Angeles.

H-4 Hunt, Mirk & Co.
141 Second Street, San Francisco.

I-1 Indiana Rubber and Insulated Wire Co. 16
807 Mission Street, San Francisco.

K-1 Kellogg Switchboard and Supply Co. 4
Aronson Building, San Francisco.

K-2 Keystone Boiler Works.
201 Folsom Street, San Francisco

K-3 Klein & Sons, Mathias. 16
579 Howard Street, San Francisco.

K-4 K-P-F Electric Co.
37 Stevenson Street, San Francisco.

L-1 Leahy Manufacturing Co. 13
Eighth and Alameda Streets, Los Angeles.

L-2 Locke Insulator Manufacturing Co. 5
(See Pierson, Roeding & Co.)

M-1 Mannesmannrohren-Werke
Rialto Building, San Francisco.

M-2 McGlauflin Manufacturing Co. 13
Sunnyvale.

M-3 Moore & Co., Charles C.
Van Nuys Building, Los Angeles; Spalding Building, Portland; Kearns Building, Salt Lake City; 40 First Street, San Francisco; Mutual Life Building, Seattle; Santa Rita Hotel Building, Tucson.

N-1 Nason & Co., R. N.
151 Potrero Avenue, San Francisco.

N-2 National Conduit & Cable Co., The
Trust and Savings Building, Los Angeles; Rialto Building, San Francisco.

N-3 National Lamp Works of G. E. Co.
(All Jobbers.)

N-4 New York Insulated Wire Co.
629 Howard Street, San Francisco.

N-5 Norris Co., L. A. 5
Monadnock Building, San Francisco.

O-1 Okonite Co. 16
(All Jobbers.)

P-1 Pacific Electric Manufacturing Co.
80 Tehama Street, San Francisco.

P-2 Pacific States Electric Co. 2
526 So. L. A. Street, Los Angeles; 90 Seventh Street, Portland; 526 Thirteenth Street, Oakland; 575 Mission Street, San Francisco; 307 First Ave., So., Seattle.

P-3 Parker Boiler Co.
201 Folsom Street, San Francisco.

P-4 Pelton Water Wheel Co. 13
2219 Harrison Street, San Francisco.

P-5 Pierson, Roeding & Co. 3
Pacific Electric Building, Los Angeles; Spalding Building, Portland; Rialto Building, San Francisco; Colman Building, Seattle; Pacific Building, Vancouver.

P-6 Pittsburg High Voltage Insulator Co., The 16
120 So. L. A. Street, Los Angeles; 343 Oak Street, Portland; 247 Minna Street, San Francisco; 560 First Avenue, Seattle.

P-7 Pittsburg Piping & Equipment Co. 16
Monadnock Building, San Francisco.

S-1 Schaw-Batcher Company, Pipe Works, The
211 J Street, Sacramento; 356 Market Street, San Francisco.

S-2 Simonds Machinery Co.
12 Natoma Street, San Francisco.

S-3 Simplex Electric Heating Co. 5
612 Howard Street, San Francisco.

S-4 Southern Pacific Co. 13
Flood Building, San Francisco.

S-5 Sprague Electric Works of G. E. Co. 4
Rialto Building, San Francisco; Colman Building, Seattle.

S-6 Standard Underground Cable Co. 16
Union Trust Building, Los Angeles; First National Bank Building, San Francisco.

S-7 Staples & Pfeiffer.
102 Steuart Street, San Francisco.

T-1 Thomas & Co., R.
(See Western Electric Co.)

V-1 Van Emon Elevator Co.
56 Natoma Street, San Francisco.

W-1 Wagner Electric Manufacturing Co. 13
Rialto Building, San Francisco.

W-2 Western Electric Co.
119 East Seventh Street, Los Angeles; 507 Sixteenth Street, Oakland; 680 Folsom Street, San Francisco; 1518 First Avenue, So., Seattle.

W-3 Westinghouse-Church-Kerr Co.
Pacific Electric Building, Los Angeles; Pacific Building, San Francisco.

W-4 Westinghouse Electric and Manufacturing Co. 6
Lewisohn Building, Butte; Van Nuys Building, Los Angeles; Couch Building, Portland; 212 So. W. Temple, Salt Lake City; 165 Second Street, San Francisco; Central Building, Seattle; Paulsen Building, Spokane.

W-5 Westinghouse Machine Co.
141 Second Street, San Francisco.

W-6 Westinghouse Lamp Co.
(See Westinghouse Electric and Manufacturing Co.)

W-7 Weston Electrical Instrument Co. 3
682 Mission Street, San Francisco.

W-8 Western Pipe & Steel Co.
1758 North Broadway, Los Angeles; 444 Market Street, San Francisco.

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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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PORTLAND GAS & COKE COMPANY.
BY HILMAR PAPST.

SHOW WINDOW LIGHTING.
BY CHARLES T. PHILLIPS.

SAFETY FIRST CONFERENCE AT RENO.

ELECTRIC HEADLIGHTS.
BY J. G. SCRUGHAM.

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Electric Storage Battery Company

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Dearborn Chemical Company

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Weston Electric Instrument Co.

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D. & W. Fuse Company

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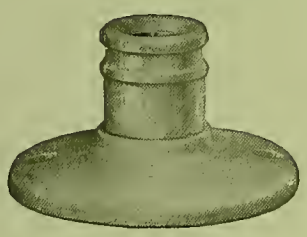
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Alphabetical Index to Advertisers, Page 8 Where to Buy It in the West, Page 9

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G-E Receptacle in styles Nos. 092 093. 094. 095 with or without key for 3¼ in. and 4 in. conduit boxes. Screw holes two 22-32 in. and three 7-16 in. on center for supporting screws.

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JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXII SAN FRANCISCO, FEBRUARY 7, 1914 NUMBER 6

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NEW PLANT PORTLAND GAS AND COKE COMPANY

BY HILMAR PAPST.

(In introducing his subject the author mentions that this public utility in making necessary extensions took advantage of the opportunity then presented to co-operate with the municipality in a "city beautiful" movement, and in describing the new plant and buildings shows how this was realized. The plant, which is quite modern, is described by Mr. Pabst, who is general manager of the Portland Gas & Coke Company.—The Editors.)

The Portland Gas and Coke Company having outgrown the facilities of its present plant, which is located in the heart of the wholesale section of the city, and also because of the manufacturing process being dirty, creating a great deal of smoke, soot, etc., it was decided to remove the plant to the outskirts of the city, in order that no offense might be given, and that a plant be erected in keeping with plans for beautification of the city. Construction work was started in June, 1911, and gas was made on October 26, 1913, or a little over two years. No money or effort had been spared to make this plant the most modern and complete. Particular attention has been paid to the elimination of whatever has heretofore been the source of complaint against gas works. In other words, the plant has been designed with a view of reflecting credit on the city and the community. It has cost $1,150,000.



General View of New Gas Plant of the Portland Gas & Coke Company.

Dock and Driveway.—The dock, which is 72 ft. wide by 106 ft. long, is built on the government harbor line and is connected with the land by a 24 ft. roadway with a walk and hand rail on either side. It required 237 piles, having an average length of 72 ft., and over 140,000 ft. of lumber to construct. The dock is provided with slips for accommodating small boats and dolphins and for mooring large craft. A sheer boom, approximately 700 ft. in length, was built to protect the dock and driveway from drift-wood and other floating debris.

The bulkhead, which is 1680 ft. in length, consists of two rows of piles 16 ft. apart, driven 8 ft. on centers, covered with two-inch planks, thoroughly braced

and battened. The whole required 417 piles, having an average length of 32 ft., and over 81,000 ft. of lumber.

Fill.—The fill, consisting of 182,000 cu. yd., was made by the Port of Portland's dredge, Columbia, and was accomplished in six weeks. The earth was pumped out of the river, thus deepening and widening the channel, at the same time making the fill.

Holders.—One holder, having a capacity of 505,000 cu. ft., was constructed for the purpose of storing the gas prior to being pumped into the city, and one additional holder, having a capacity of 650,000 cu. ft., was dismantled at Fourteenth and Couch streets, shipped and re-erected in a new steel tank at the new plant, for the purpose of receiving the gas immediately after having been manufactured.

Office Building.—This building is 52 ft. by 52 ft. in plan and three stories in height, with a one-story addition in the rear 45 ft. by 90 ft., used for meter room. The walls and floors are constructed of reinforced concrete and the roof of steel trusses and purlins, which are covered wtih matched lumber, asbestos felting and composition asbestos shingles. The outside walls are bush-hammered or tooled over the entire surface of the concrete, which gives the effect of cut granite. The cornice, down-spouts and other metal work are of copper. The hipped roof of the main building is surmounted by a clock tower constructed of steel and covered with copper. The clock is of the Standard Electric Company's make, designed with four illuminated dials, which make it possible to note the time from all directions.

The interior of the building is of fireproof construction throughout, having kalamein doors, metal-covered sash, casings, etc., and terrazo and concrete floors. The interior walls are tinted and decorated, and all frames and finish are painted.

On the first floor is located the engineer's office, a reading and lounging room for the men, a kitchen, completely equipped for the use of the men during lunch hours, a large room for the timekeepers and foremen, and a spacious hallway.

The second floor contains the chemical laboratory, wash and dressing rooms, including bath tubs, shower baths and lockers, and a bedroom completely equipped for emergency use; while the third floor is a large assembly hall in which the details and general work of the plant will be discussed.

The basement, which is finished equal to the remainder of the building, will be used as a storeroom, in which a complete stock of pipe, fittings and other necessities will be carried.

In the meter room, in the rear of this building, as described, is one large gas station meter 16 ft. in diameter and 16 ft. long, with provision for two additional meters. These meters will measure all gas made, prior to delivery into the city.

Machinery Building, or Power House.—This is 90 ft. by 150 ft. in plan, and one story high, with large basement. The walls and floors are constructed of reinforced concrete, and the roof of steel trusses and purlins, which are covered with matched lumber, asbestos felting and composition asbestos shingles. The underside of the roof is thoroughly fireproofed with asbestos protected metal. The outside walls are bush-hammered the same as the office building, and the cornice and other sheet metal work is of copper. The interior is fireproof, having tile partitions, metal window frames and doors. It is tinted and painted throughout.

Here the power for operating the various machinery around the plant is generated. One battery of 300 h.p., high-pressure, superheated steam boilers has been installed and provision made for two additional boilers. One steel stack 10 ft. in diameter and 200 ft. high, has been erected with breeching and necessary openings left for connectors to future boilers. Two 500 kw. alternating current electric generators have been installed complete, including exciters, switchboards, condensers and other accessories. Two centrifugal gas exhausters, each having a capacity of handling 5000 cu. ft. of gas per minute against one pound pressure, have been erected for pumping the gas through apparatus for purification. Two steam-driven compressors, each having a capacity of handling 5200 cu. ft. of gas per minute against 20 lb. pressure are installed complete, including condensers, for the purpose of pumping the gas into the city. One traveling crane, running the entire length of the building, is in place to facilitate repairs and additions to machinery. In this building, also, is located a large wash and locker room, including toilets, shower baths, steel lockers and numerous other conveniences for the men.

Generator Building.—This building is 60 ft. by 180 ft. in plan, and more than two stories in height, although there is only one floor. A large basement is under the entire building, affording ample storage capacity for fire brick, etc. The walls and floor are constructed of reinforced concrete, and the roof of steel trusses and purlins, which are covered with matched lumber, asbestos felting and composition asbestos shingles. The underside of the roof is thoroughly fireproofed with asbestos protected metal. The outside walls are bush-hammered the same as the other buildings, and the cornice and other sheet metal work are of copper.

The interior finish is also fireproof, being constructed of sheet metal throughout.

This building contains the generators in which the gas is manufactured, three of these machines, 20 ft. in diameter by 30 ft. 6 in. high, having been erected. Three blowers, each having a capacity of delivering 7290 cu. ft. of free air per minute against a pressure of one pound, have been installed, for the purpose of supplying air to oil burners on gas machines. In this building, also, is located the reheating plant, which consists of two machines, each 10 ft. in diameter by 35 ft. high, for the purpose of reheating the gas, which is part of the purifying process.

Briqueting Plant Building.—This is 90 ft. by 110 ft. in plan, and one story in height. The floors are of reinforced concrete, the walls are of heavy wooden columns, filled between with hyrib metal lath and plaster, and the roof is constructed of heavy wooden trusses, sheathing and asbestos felt. The building is also of fireproof construction, practically all of the woodwork being covered with metal lath and plaster, and all windows and door frames metal covered. The outside appearance of the building gives the same

effect as reinforced concrete, and this harmonizes with the remainder of the buildings.

It contains the machinery for manufacturing carbon briquets, which is now the purest fuel that is on the market, being composed of 90 per cent carbon and volatile matters, with only 2 per cent of ash, thus giving the greatest possible amount of heat units with practically no waste. Three large filters, 15 ft. in diameter and 18 ft. in length, each having a capacity of handling 1500 gal. of water per minute, have been installed, together with air, vacuum and water pumps and other secondary machinery. Two cylindrical, revolving dryers, each 75 in. in diameter and 45 ft. in length, have been installed for drying the carbon, after same has been filtered. One briquet press, weighing about 15 tons, has been erected for forming the briquets ready for market.

Briquet Storage Building.—This is 200 ft. by 210 ft. in plan, and one story in height. It also will be used for storing the briquets prior to being sold, and has a capacity of 15,000 tons. The walls are constructed of heavy wooden columns, filled between with hyrib, metal lath and plaster, and the roof of heavy wooden trusses, sheathing and asbestos felt. The building is of semi-fireproof construction, practically all of the woodwork being covered with metal lath and plaster. The general outside appearance of this building also harmonizes with the others.

Oxide and Shavings Storage Building.—This building, 100 ft. by 100 ft. in plan, and practically two stories in height, although it has but one floor, will be used for the storage of shavings and chemicals which are used in the purification of the gas. The floor is made of concrete, and walls, roof, etc., are of the same construction as the briquet storage building.

Pump House.—The pump house is 15 ft. by 35 ft. in plan, and three stories in height. It is constructed mostly below the surface of the ground, as the bottom part is 6 ft. below the mean water level of the river. It is built almost entirely of reinforced concrete, except the facing of the outside walls, which is of hard-burned paving brick. The roof is made up of steel trusses and purlins, wooden sheathing, asbestos felting and composition asbestos shingles. To admit the water from the river to the pumps, a large flume or intake has been built. This intake is 24 ft. deep, 8 ft. wide and 170 ft. long, and constructed of creosoted sheet piling and large timbers.

Two 10-in. centrifugal water pumps, each having a capacity of delivering 2500 gal. of water per minute against a 130-ft. head, have been installed, for the purpose of supplying water to the plant. Provision has been made for the installation of two additional pumps. Two high-pressure oil pumps, each having a capacity of delivering 50 gal. of oil per minute against a pressure of 250 lb., have been installed, and foundation made for one other pump.

Purifiers.—These purifiers are filled with shavings chemically treated, for the purifying of the gas. They are four in number, 32 ft. diameter by 20 ft. high, and of sheet steel, and three additional purifiers of the same dimensions have been moved down from the old plant, and all necessary piping and connections made.

Oil Tank.—One 55,000 barrel steel oil tank, 114 ft. 6 in. in diameter and 30 ft. high, has been provided for the purpose of storing the oil used in the manufacture of the gas.

Tar Tank.—This is a 6000 bbl. steel tank, 42 ft. in diameter and 52 ft. high, and has been erected for the purpose of storing the tar, which is a residual of the gas.

Water Tank.—One 100,000 gal. water tank, with steel tower, has been erected for the purpose of storing the works' water supply.

Piping.—The large mains for conveying the gas are 42 in., 36 in. and 30 in. The water lines are 20 in. and smaller, and the steam and oil 10 in. and smaller. The steam and oil lines are tested for a working pressure of 250 lb., the water lines for 125 lb. and the gas mains for 50 lb. per sq. in.

Capacity.—The plant in general has been designed for an output of 15,000,000 cu. ft. of gas per day, and the buildings have been constructed of sufficient size, and foundations installed to receive this amount of machinery. At present, however, only enough machinery to manufacture 7,500,000 cu. ft. per day is in place.

Streets and Grounds.—An artistic system of concrete sidewalks and curbs has been installed, and the streets are now being paved with reinforced concrete pavement. Numerous lamp posts with gas arcs are being erected along the streets and in dark corners of the grounds. The lawns, which were planted during the summer, are now thriving and add a finish to the entire plant.

LETTERS TO THE EDITOR.

San Francisco, January 27, 1914.

To the Editor:—We note the change which you have instituted in the classified advertising section of your journal, and it appeals to us as being a very satisfactory re-arrangement that will be found convenient for the use of your patrons.

We wish to say that your journal is very much appreciated in our office, as we frequently find articles of very considerable interest to us.

Wishing you the best of success, we are

Yours very truly,

WESTERN PIPE & STEEL CO. OF CAL.,

(Signed) F. B. Kinsman, Secretary.

Portland, Ore., January 10, 1914.

To the Editor:—The Portland Railway, Light & Power Company has been courteous enough in the past to permit our use of their copy of your Journal of Electricity, Power and Gas. This has been a little bit unfair to them and more so to the Journal, and yet, we have suffered most from it because of the hurried attention we have felt obliged to give to the many valued articles appearing.

We wish to change this and wish you would place the name of this association on your mailing list for a year's subscription, dating from the first issue in 1914. Yours very truly,

(Signed) H. C. HAZZARD,

Secretary Pacific Coast Electric Railway Association.

EFFECT OF FORESTS ON RUN-OFF.

By J. C. STEVENS

(Continued.)

Two lines of inquiry will be followed: (1) as to the effect on the total yield of a drainage area; and, (2) as to the effect on uniformity of flow. I have been unable to ascertain the exact claims made by forestry advocates as to the effect of forests on the total yield of a drainage area. In fact, the influence in this particular appears to be charmingly elastic. If forests exist in a humid country, they are said to increase the total run-off. In countries of scanty rainfall, they are said to decrease the total yield. Mr. Pinchot states, in his little book, "The Fight for Conservation," p. 53:

> The connection between forests and rivers is like that between father and son. No forests, no rivers.

This, perhaps is not intended as a scientific view of the case, but the impression Mr. Pinchot would convey and the thing he would have the public believe is that forests increase the water supply.

In Bulletin No. 44, Bureau of Forestry, "The Diminished Flow of Rock River in Wisconsin and Illinois and Its Relation to the Surrounding Forests," p. 9, the author says:

> On the whole it is safe to say that a larger proportion of the precipitation gets ultimately into the streams from a forest-covered region than from one that is unforested.

Mr. George W. Rafter, Water Supply and Irrigation Paper No. 80, "The Relation of Rainfall to Run-Off," p. 53, makes this statement:

> The extent of forestation has probably a considerable effect on the run-off of streams. With similar rainfall, two streams, one in a region having dense primeval forests, the other in a region wholly or partially deforested, will show different run-off. The one with the dense forest will show larger run-off than the stream in the deforested area. In some parts of the state of New York these differences may amount to as much as five or six inches in depth over the entire catchment area.

Mr. James W. Toumey, Yearbook, Department of Agriculture, 1903, p, 287, Collaborator, Bureau of Forestry, says:

> In regions characterized by a short wet season and a long dry one, as in southern California and many other portions of the West, present evidence indicates, at least on small mountainous catchment areas, that the forest very materially decreases the total amount of run-off.

The facts are, however, that if the forest has any influence at all, it is to decrease the total run-off in all cases, owing to the greater evaporation, transpiration and storage in the humus. On a watershed where forests have been removed, therefore, we should find a greater yield for the same precipitation.

This conclusion appears to be a rational one, and has in support thereof the well known fact that forests are not found in regions where there is less than 20 inches of rainfall per annum. Nature has made a wise provision in this respect. In well-watered countries the forests grow in profusion and help to diminish the total run-off by their evaporation, transpiration and humus storage. In such cases we are over supplied with water and the forest aids in its dissipation. In region of scanty rainfull, all the water is required and the forests are less luxuriant, or absent, hence a greater part of the precipitation is available for the uses of mankind.

The foregoing apply to the total yield of a watershed only, and must not be construed as applying to the uniformity of flow. On this point the pro-forestry advocates are unanimous in the belief that forests induce greater uniformity of flow. The agencies by which this is said to be accomplished have already been discussed. We will now examine the records themselves.

I submit below practically all the long time records available, of both precipitation and runoff, on watersheds where a change in forest cover has taken place. There are not many examples of this kind. It is admittedly impossible to find out, without great expense, the actual amount of forest changes; nor is it important to know more than that such changes have occurred during the period of record and that they are material changes.

I have expressed the runoff each year as depth of water in inches over the entire drainage area, and the precipitation in the same unit. Divide one by the other and obtain the "runoff per inch of precipitation." It will be found that even under the same surface conditions this quantity will vary from year to year. This variation is due to the variation in amount and distribution of precipitation and to the resultant ground storage. If we start the year with full ground storage, a much larger proportion of that year's precipitation will run off than if the ground storage was depleted at the beginning of the year and had to be replenished. It takes a certain amount of precipitation to produce any runoff at all.

In arid countries large areas frequently receive from six to ten inches of precipitation each year, and yet yield no runoff. There are a multitude of other conditions and factors, and it is obviously impossible to take them all into consideration. We will generally find that the runoff per inch of precipitation will itself increase or decrease with the precipitation, i.e., during wet years a larger proportion runs off than in dry years. In a long series of years, however, these influences tend to balance each other, and if the records include both forested and non-forested period, the effect of forests should be detected.

I have treated all these records in successive periods, inquiring first as to the change in the total quantity of runoff, and second as to the uniformity of flow.

Tennessee River Basin.

The records of discharge have been compiled from gauge readings kept at Chattanooga, Tenn., by the U. S. Army Engineers. Discharge measurements have been made by the U. S. Geological Survey, by which these gauge readings are translated into mean discharges for each day of the year. The precipitation data is taken from records of the U. S. Weather Bureau.

The record covers 35 years, from 1874 to 1908. The most active lumber operations in the upper portion of the drainage basin have been carried on during the past 20 years. Before the seventies the forested areas in the mountainous regions were practically the same as before the advent of white settlers. Since the beginning of the record, about 25 per cent of the forests on the drainage area have been

removed. The total drainage above Chattanooga is 21,400 square miles, of which about 60 per cent is still in forest, some of which has been partially culled for certain species, and over which have run fires of more or less severity since the country was first settled. (These data taken from Professional Memoirs Engineer Bureau U. S. Army, Vol. 1, No. 4, p. 389, and Professional Paper U. S. Geological Survey No. 72.)

I have chosen this stream because the records are reliable and because they have been used extensively by pro-forestry advocates as an example of the "calamities" that inevitably follow the "ruthless" destruction of our forests. According to Leighton, (Water Supply paper No. 234, p. 23), the effect of deforestation on the runoff of this stream has been to increase the flood severity and flood frequency 18.75 per cent since 1884. In my analysis I have used the identical figures for precipitation and discharge used by Mr. Leighton.

The following table gives the essential facts in regard to the runoff from this watershed. The entire interval of record has been divided into four periods, and the figures given are the averages for these periods as shown.

Tennessee River, at Chattanooga, Tenn.
(Drainage Area, 21,400 Square Miles.)

Period.	Precipitation. (inches)	Runoff. (inches)	Runoff per in. of precipitation. (inches)	Maximum discharge. (sec. ft.)	Minimum discharge. (sec. ft.)	Uniformity. Ratio
1st 9 years—						
1874-1882..	58.1	26.5	.45	221,000	7,960	.036
2d 9 years—						
1883-1891..	51.7	27.4	.53	242,000	8,660	.036
3d 9 years—						
1892-1900..	48.8	22.6	.46	218.000	8,950	.041
4th 8 years—						
1901-1908..	49.9	24.5	.49	191,000	9,990	.052

The Tennessee basin is decidedly a humid region, and if the current forestry theories are correct, we should expect to find a material decrease in the runoff per inch of precipitation separate and apart from that which would naturally follow the decrease in rainfall during the period. The rainfall records are not nearly as accurate as those of runoff and too much significance must not be attached to them, especially the earlier records. Apparently the runoff per inch was least when the rainfall was greatest (1st period) and the area of forest cover was also greatest. This apparent result while directly contradictory to the popular forestry theory, is doubtless due to inaccuracies in the precipitation records and we should not attach significance to it. Beginning with the second period we see that with a decreasing rainfall the runoff per inch also decreases as before pointed out. The forestry theory would lead us to believe that this quantity should increase with a decrease in the forest covered area, but such is not the case.

Fig. 1 shows the precipitation, runoff, and runoff per inch of precipitation plotted for each year, together with the averages by periods, as given in the table. The general parallelism of these hydrographs is striking. It proves conclusively that variations in runoff are produced by variations in precipitation, and that if any other influence exists it is of no moment.

Inquiring next as to the uniformity of flow, the last three columns in the above table furnish interesting data on this point. The forestry theory teaches that forests induce lower high-waters and higher low-waters than would obtain without them. Column five gives the average maximum yearly discharge, and column six gives the average minimum yearly dis-

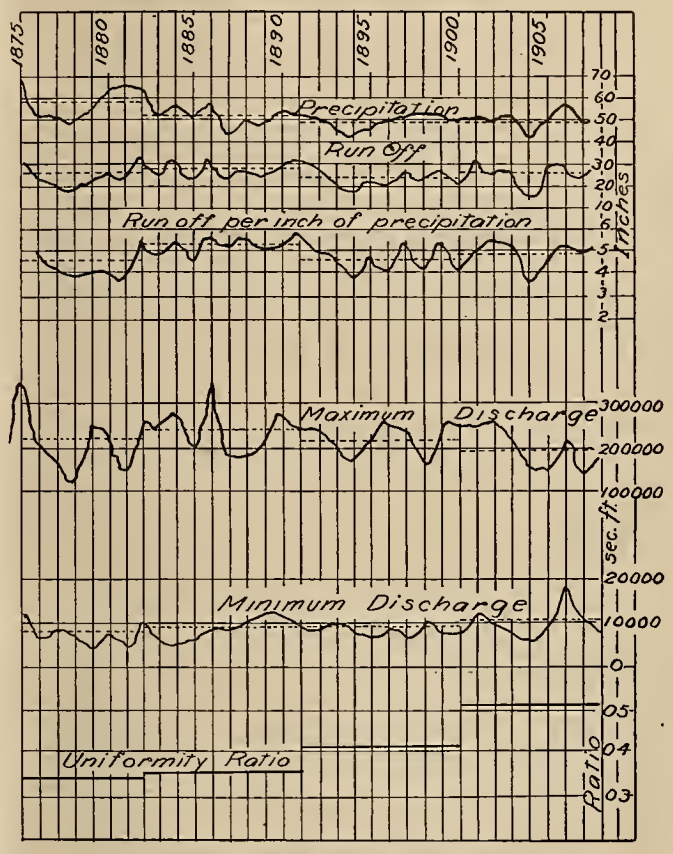


Fig. 1. Tennessee River Chart.

charge, for each period. Column seven is obtained by dividing the minimum by the maximum, and is a measure of the uniformity of flow. It is therefore called the "uniformity ratio." A stream whose flow was the same every day (if such were possible) would have a uniformity ratio of 1.00, while a stream that went entirely dry would have zero as a uniformity ratio. Hence the larger this ratio, the more uniform the flow.

It is seen that this ratio has persistently increased coincident with a reduction in the forest area on the watershed. This directly controverts the forestry theory. On this stream flood lights are substantially lower, and low water flow materially higher, than when its drainage area was heavily forested. However, the cause must be looked for entirely outside of forestry effects.

This system of analysis does not take full account of the moderate freshets—only the maximums each year being considered. To make a proper study of this feature involves an enormous amount of labor, since daily records of discharge and precipitation would have to be critically analyzed and each freshet expressed in terms of the rain that produced it. This will involve also an arbitrary assumption of what constitutes a freshet, different assumptions as to this quantity yielding entirely different results.

[To be continued.]

LIGHTING METHODS

SHOW WINDOW LIGHTING.

BY CHARLES T. PHILLIPS.

(There is much room for improvement in store window lighting. Fundamental requirements of good lighting are stated and a different viewpoint as to what constitutes in window lighting the plane of illumination. Mr. Phillips is a consulting engineer, San Francisco.—The Editors.)

There is no portion of a store that will bring as large returns on the investment as a properly designed system of show window lighting, yet, the few windows that are properly lighted, are only a small percentage of the whole. A show window that is poorly lighted is not a good sales medium. Results can be made large or small, depending almost entirely upon the kind of light sources used, and upon their arrangement. The problem of proper lighting has two sides, first the physical, or method of producing the light, and second, the psychological, or the effect of the lighting on the observer. The systems which are frequently used may be condemned from either side. A show window that is lighted with exposed light sources of high intrinsic brilliancy will be condemned for the psychological effect, although there might be sufficient light of proper quality. The show windows are to sell goods and not the electric lights and fixtures, but, if the latter are exposed to view, the observer's attention is attracted from the window display to the light sources.

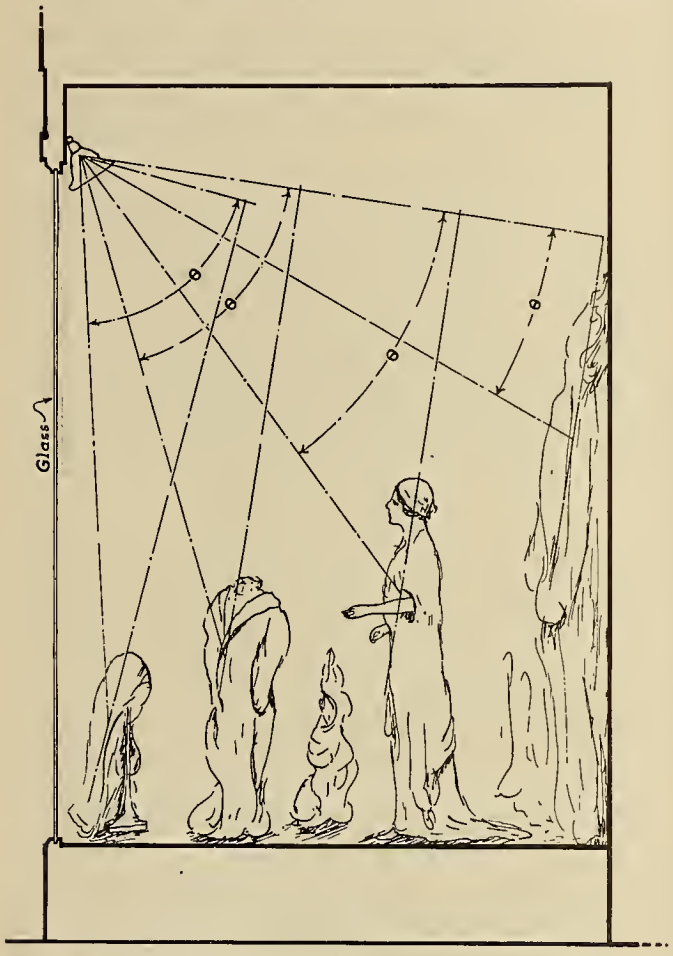


Fig. 1. Showing Vertical Illumination Required.

Illumination can be briefly defined as the effect of light, light being the cause and illumination the result. We must consider then, not only the light sources themselves, but also the resultant illumination.

The proper lighting of a show window depends upon the style, character of the goods displayed and the effect desired.

The best authorities on show window lighting agree that the light sources should not be exposed, but that the window should be treated the same as a stage in a theater. The goods displayed should be well lighted by concealed lights and it is best to have the side walls and ceiling finished in light tones. White or ivory, with a matt surface, is perhaps the best, especially if the display is in dark colors. It is almost impossible to light a show window satisfactorily in which the walls and ceiling are finished in mahogany or painted in dark colors.

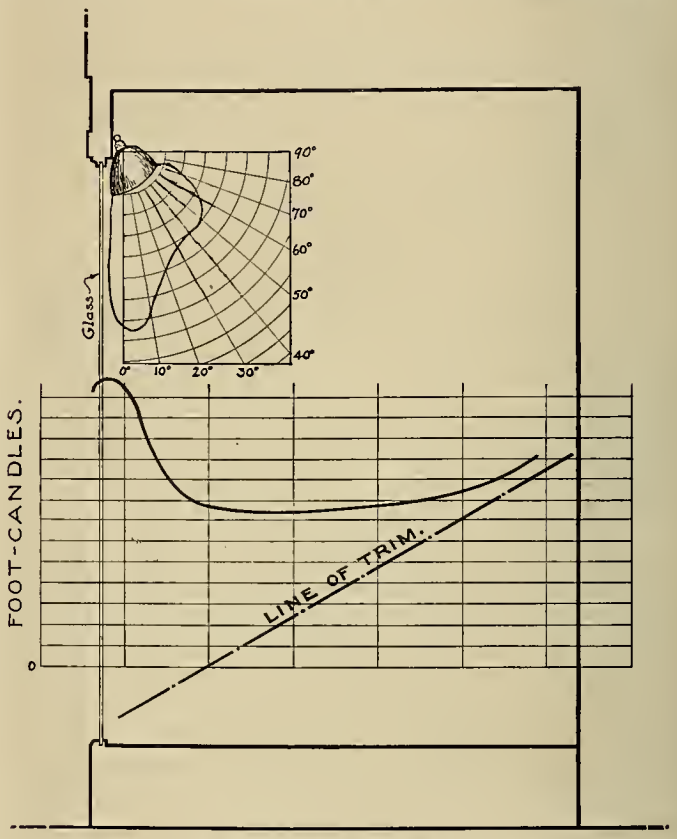


Fig. 2. Curves Indicating Greater Intensity in Front Part of Windows.

In order to see a window display clearly and easily, without eye strain, the following considerations must prevail: There must be sufficient illumination; that is, enough light must be reflected from the objects displayed to the eye. For this reason, much more light must be thrown on a dark display than on a light one, the co-efficient of reflection of the dark objects being much less than that of light ones. Too much

light must be avoided. The iris of the eye can contract only to a certain extent and is soon fatigued by a strong light. As the iris weakens, it expands, allowing the strong light to strike the retina, producing eye strain. If this is continued the eye may be permanently weakened. Bright lights in the field of vision should be avoided, as the picture of the light source itself will be formed on the retina of the eye and other objects will seem dim in comparison. The lamps should be placed so that the light is not regularly reflected to the eye. Light which consists largely of a predominating color is undesirable, as the color value of objects illuminated is thereby changed.

The intensity required for show window lighting depends upon the location of the window (whether in a brilliantly lighted street or in some street where the lighting is not so good) whether or not the adjoining windows are well lighted, the kind of display and the class of trade to which the merchant caters.

There is perhaps more waste in the illumination of show windows than in any other department of a store. If the same loss occurred proportionately in other departments, it would mean quick bankruptcy. A merchant may display phenomenal intelligence in other matters, yet, in selecting a system of illumination which is supposed to be a permanent investment, he will disregard absolutely every law pertaining to the subject, and then be surprised that the installation is not satisfactory. If he should be satisfied with the light, there is still the chance that the installation will be expensive and the monthly bill high. He may appreciate the fact that salesmanship is a science and that it is necessary to have a high grade department manager for each particular line, but, the fact that illumination is a science and that high efficiency is obtained by the application of scientific knowledge, does not seem to be appreciated by him.

Perhaps the most common error in show window lighting is where a satisfactory installation is copied from another window where the conditions are radically different. An argument frequently brought forth is that a certain make of reflector is being used or that the reflector is of first class material, or that such and such a store is using them. Whether or not the design is particularly adapted to the case at hand, seems to bear very little weight. The loss in efficiency or undesirable results may be more a matter of the type of reflector used than of any other item. A high grade reflector may be used, and the installation even then prove ineffective.

We frequently hear it said of a badly designed installation that it is giving satisfaction. It may do so to a certain extent, but it would seem that if it gave the same satisfaction for less money, or better results for the same money, it would be more in keeping with modern business methods.

The general opinion seems to be that to get the best results in illuminating a show window, an imaginary plane, called the line of trim, should be evenly illuminated. This may seem to be the proper method, but it must be conceded that very rarely is the display so arranged that this will obtain the maximum results. A jewelry, and, possibly, a shoe display may be so arranged that this method will give satisfaction, but for clothing, dry goods, furnishings, etc., the results will not be good.

Surface brightness should be the criterion of sufficient illumination. With an even intensity on the line of trim, objects in the foreground will not be as well lighted as those in the background.

The surface to be illuminated does not lie in the same plane as the line of trim, as usually shown, but more in a vertical plane. This is clearly shown by Fig. 1. The writer has obtained excellent results by increasing the intensity materially at the front of the window, as shown by Fig. 2.

Economy of current consumption is not the only really important consideration, though there are many engaged in various branches of the electric lighting industry who take that view. Their arguments to the consumer are often based solely upon the proposed reduction in the monthly electric bill and not often enough upon improvements in lighting conditions. The complaint from the consumer, may be that the current bills are too high for the amount and quality of light but, what the consumer usually desires, is more illumination rather than a smaller bill. In fact, experience shows that when the quality and quantity of the illumination has been increased, the merchant is apt to increase his energy bill by keeping the windows lighted for longer hours.

METHOD IN HOME LIGHTING.

[Continued.]

6. Dining Room.

Dining room and dome seem almost inseparable and to pry them apart would necessitate a complete knowledge of the arrangement of the room in which the installation is to be made and of the tastes of the owner.

In a room with dark decorations the bright light thrown on the table from the average dome fixture equipped with high efficiency Mazda lamps is altogether too brilliant. If the dome is suspended at a mounting height which allows the light to cover nicely the family table, the effect is too spotty when the table is lengthened, while to use the common type of dome fixture at a mounting height sufficient for the extended table to be evenly illuminated, is to usually bring the bare lamps within the range of vision. It is practically impossible to properly illuminate a long table with one center dome fixture.

In correct practice, dining room dome fixtures should be equipped with a translucent reflector of light density opal glass, rough inside and rough outside (a velvet finish prismatic reflector would also be suitable), and a bowl frosted Mazda lamp of comparatively low wattage. It is sometimes advisable, and at others as a matter of taste, to fit a diffusing screen of either silk or glass in the opening of the dome so that the light on the table is more diffuse and mellow. This screen would also serve to subdue the light falling directly on the eye where necessity compels suspension of the dome at greater than the regular height above the table.

There are still those people who prefer to dine by candle-light, because it is so soft and pleasant, but there is no reason why electric light should not prove equally effective. It is certainly safer.

To relieve the darkness of the upper walls and ceilings, emphasized by the localization of the light on the table, round bulb low wattage totally obscured

(frosted) lamps are sometimes installed around the canopy of the dome, or on beamed ceilings, at the intersection of beams.

With such lighting, important pictures should be illuminated, though to a low intensity, with localized lighting, opaque reflectors reflecting the light diffusely being used for that purpose.

A floor outlet should be provided to allow the installation of decorative lamps. This would permit the use, on the table, of an electric percolator, toaster, etc., as well.

Shower fixtures with carefully selected glassware are also in order. It is then advantageous to provide buffet fixtures or sidewall brackets. The glassware then used should be very mellow, such as Tiffany ware, or of very heavy density, seeing that these bracket lights are sure to, at some time, come within the range of vision.

Indirect lighting is very well suited to this purpose, but in rooms with beamed ceilings the heavy shadows cast are an objectionable feature. The dark beams absorb quite a lot of light.

Where indirect lighting is used and a multiple light fixture makes this arrangement possible, a three-way switch should be installed so as to permit the use of a low or greater intensity of illumination at will, one lamp, perhaps, being first switched on and then two or more added.

A further suggestion with regard to cheap, unsightly, and unscientific fixtures. It is far better not to buy them, but to rather secure a few good fixtures and use drop cords as make-shifts until the high-class fixture can be purchased.

One room in which an agreeable temporary economy may be effected is the dining room.

A round or many-sided light-weight though stiff wire frame should be secured, care being taken that it can be fitted to the drop cord socket in such manner that the silk with which it is covered does not touch the lamp. The frame should be not less than 24 in. in diameter and further insurance from scorching and a better effect can be secured if a reflector is also used similar to that recommended for use with the regular dome. A frill of the same material as that used for the cover, and sometimes the use of heavy lace around the edge also, will in the hands of the deft housewife make a very pleasant substitute fixture.

There is a tendency to immediately choose a very deep red for this purpose, but unless the reflector is also used this should be avoided, as that color absorbs so much light. Otherwise a light amber color is very pretty and serviceable, though there are many others as good. With a little forethought as to the proper combination of white cloth, shade, flowers and silverware, this temporary makeshift may be made both serviceable and pleasing.

The main object sought in dining room lighting is to flood the table with a mellow light and in such manner that it will also illuminate the faces of diners to advantage, be so restful and harmonious that without being conscious of the equipment the effect of the lighting will be pleasing and so contribute to an enjoyable meal.

7. The Den.

Here is one room in which economy of current consumption on account of the small area to be lighted, Where indirect lighting is used a multiple light is unimportant. It depends however upon the exact use to which the room is to be put whether a combination of local and general illumination should be used or of general illumination only. In either case, indirect lighting is, in the main, to be preferred.

Intensities should be sufficient for easy reading or writing.

[To be continued.]

CENSUS FIGURES ON ELECTRIC LIGHT AND POWER.

Preliminary figures of the forthcoming quinquennial report on the central electric light and power stations of the state of Utah have been given out by Director W. J. Harris of the Bureau of the Census, Department of Commerce. They were prepared under the supervision of W. M. Steuart, chief statistician for manufactures.

The statistics relate to the years ending December 31 for 1912 and 1907, and June 30 for 1902, and cover both commercial and municipal electric plants. They do not include electric plants operated by mining companies, factories, hotels, etc., which consume the current generated, those operated by the Federal Government, and state institutions, or plants that were idle or in course of construction.

The figures as presented for Utah show that during the decade 1902-1912 there were general gains in the industry. The number of commercial establishments in the state increased from 15 in 1902 to 28 in 1912, a gain of 87 per cent. The total income was $1,516,410 in 1912 as compared with $714,353 in 1902, a gain of 112 per cent. The total expenses increased 99 per cent—from $607,769 in 1902 to $1,206,729 in 1912. The total horsepower developed from water wheels showed a gain of 224 per cent, or from 18,410 in 1902 to 59,588 in 1912. That the arc lamp is being superseded in Utah by the incandescent and other varieties is shown by the decrease of 77 per cent in the number of arc lamps reported as wired for service, and the increase of 63.2 per cent in all other varieties.

The figures are shown in detail in the accompanying table:

Utah.	1912	1907	1902	Per cent of increase [1] 1902-1912.
Number of establishments	45	31	16	181.2
Commercial	28	22	15	86.7
Municipal	17	9	1	.....
Income	$1,516,410	$665,241	$714,353	112.3
Light, heat and power	$1,497,205	$627,332	$664,240	125.4
All other sources	$19,205	$37,909	$50,113	—61.7
Total expenses, including salaries and wages	$1,206,729	$461,675	$607,769	98.6
Total number of persons employed	401	198	240	67.1
Total horsepower	60,588	35,950	20,460	196.1
Steam and gas engines (including turbines):				
Number	6	10	9	—33.3
Horsepower	1,000	1,279	2,050	—51.2
Water wheels:				
Number	63	45	26	142.3
Horsepower	59,588	34,671	18,410	223.7
Kw. capacity of dynamos.	37,935	33,592	13,923	172.5
Output of stations, kw.-hr.	86,634,658	61,672,661	32,457,063	166.9
Estimated number of lamps wired for service:				
Arc	333	[2] 440	1,469	—77.3
All other varieties	150,380	[2] 67,670	92,165	63.2
Stationary motors served:				
Number	1,044	406	295	253.9
Horsepower capacity	37,490	5,519	5,868	538.9

[1] A minus sign (—) denotes decrease.

[2] Exclusive of 7 arc and 1,929 lamps of other varieties reported by the electric companies as used to light their own properties. Lamps used for such service were included in the number reported for 1912.

SAFETY FIRST CONFERENCE AT RENO

One of the most unique and interesting meetings ever held in a western state was the "Safety First" Conference at Reno, on January 26 and 27th. It was unique because probably the first instance in the country where a movement arousing such state-wide interest was inaugurated and carried to a successful conclusion by state officials,—in this case the State Industrial Commission of Nevada and the Mechanical and Electrical Department and Engineers' Club of the University of Nevada. The meeting was interesting in that it brought together mine managers and miners, railroad officials and trainmen, manufacturers' representatives, power plant superintendents and operators, members of the university faculty and students, state officials, labor representatives, engineers and professional men —the total attendance being six hundred. It was productive of lasting benefit in that it focused the attention of the entire state on the "Safety First" movement, leaving as a record valuable papers and discussions.

The conference opened Monday afternoon in the University gymnasium with W. E. Wallace of the Brotherhood of Railroad Trainmen and State Industrial Commissioner, and Professor James G. Scrugham as presiding officers. The following papers were presented at this session:

"The 'Safety First' Movement in Nevada," by John J. Mullin, secretary Nevada Industrial Commission, in which he described the organization of the commission and dwelt on its future work and the co-operation between employer and employe that was necessary to make the movement a success.

L. E. Abbott, safety commissioner of the Oregon Short Line, gave a very interesting account of "'Safety First' on the Oregon Short Line," showing with what enthusiasm the work had been taken up and what splendid results in the saving of life and limb had been accomplished on that railroad system.

"'Safety First' in Practice" was handled by Frank Ingram, secretary Brotherhood of Locomotive Firemen and Engineers. Mr. Ingram discussed some of the safety precautions that had been inaugurated by the employes of the railroads in the state, dwelling principally on the law which the trainmen had succeeded in placing on the statutes of Nevada requiring locomotives to be equipped with 1500 candlepower arc headlights.

J. H. Linn of Topeka, Kansas, gave a short description of the safety work on the Santa Fe System and followed with a very interesting paper on the Student apprentice system of the Santa Fe with which work he is connected as assistant chief instructor.

J. M. Guild, secretary of the Bureau of Safety of the Union Pacific, followed with a short description of the work on that road.

Professor H. P. Boardman, head of the Civil Engineering Department of the University of Nevada, gave some very interesting remarks on "Safety First in Civil Engineering." He showed how necessary it was in designing structures to use proper safety factors, citing the Quebec bridge failure as an example where all the necessary precautions had not been taken. Two conclusions drawn from this failure were that a structure which might be satisfactory and safe on a small scale might not be safe when constructed in a similar manner on a much larger scale—also that certain members of a structure may be subjected to greater strains during erection than after completion, thus necessitating corresponding greater strength. He also touched on the necessity of automobile drivers exercising more "safety first" precautions.

A paper entitled "The Prevention of Accidents," by C. W. Price, safety engineer, Wisconsin Industrial Commission, was read by the secretary, Mr. Price not being present. The paper described some of the remarkable results that have been obtained among eastern corporations and then gave in detail the necessary steps to be followed in introducing a "Safety First" movement in an industrial organization.

Monday evening was given up to wireless telegraphy and discharges of high potential electricity, the demonstration being made by the Department of Electrical Engineering and Physics of the University, followed by motion pictures of "Safety First" on the Union Pacific; The Manufacture of Steel, loaned by the U. S. Steel Corporation; University of Nevada Campus and Laboratory Views, and National Mine Rescue Demonstrations loaned by the U. S. Bureau of Mines.

Owing to the severe storm of the 25th and 26th many of the delegates were delayed in reaching Reno, so the electrical papers were held over until Tuesday. On the morning of that day a very interesting meeting was held of railway apprentice instructors of the Southern Pacific, Santa Fe, Oregon Short Line and Union Pacific. The meeting was presided over by Norman Collyer, executive secretary to the president of the Southern Pacific Company, and papers were presented by Hon. John Edwards Bray, Nevada State Superintendent Public Instruction. Thos. G. Gray of the Sacramento and H. S. Gillette of the West Oakland shops of the Southern Pacific; Mr. Linn of the Santa Fe and A. W. Preston, shop superintendent of the University of Nevada. On the preceding day, Mr. Collyer had addressed the engineering students of the university on the apprentice system for college men in operation on the Southern Pacific System.

At the electrical section of the conference on Tuesday morning at which A. H. Babcock, electrical engineer of the Southern Pacific presided, a very interesting discussion was held on "Safety Regulations for Electric Power Companies," the leading paper being by W. K. Freudenberger, chief engineer of the Nevada State Public Service Commission.

The principal session of the conference was the general meeting on Tuesday afternoon at which Governor Tasker L. Oddie presided. At this session chief interest centered in the discussion on electric headlights which was introduced in a valuable paper by J. G. Scrugham, professor electrical and mechanical engineering of the University of Nevada. This paper and discussion and a mention of the tests conducted at the close of the conference are presented elsewhere in this issue.

Following the headlight discussion, after a demonstration of the talking arc, the following papers were presented:

"'Safety First' in Mining," by Thos. M. Fagan, president of Tonopah Miners' Union, in which he discussed in an eloquent manner the relation of the employe who sells his labor, to the employer and the state, dwelling particularly on features of the Nevada Insurance and Compensation Act.

"'Safety First' at Nevada Consolidated Copper Company's Plant," by Lindsay Duncan, mechanical engineer of that company, was read by title in the author's absence.

Edward Ryan, state mine inspector, gave a very interesting paper on "Accident Prevention in Mining," dwelling particularly on the necessity of educating employes to their own dangers. At the close of his talk Mr. Ryan demonstrated the miners' oxygen helmet and rescue outfit, and the pulmotor, all of which are endorsed by the U. S. Bureau of Mines.

A. W. Hunsinger of the Goldfield Miners' Union, spoke of accident prevention and was followed by Rev. Lloyd B. Thomas, Carson City, Nevada, who gave his impressions as a visitor at the Safety Conference held under the auspices of the American Museum of Safety in New York, December 10-12, 1913.

At the close of the meeting a communication from Secretary Cameron of the National Council for Industrial Safety urging the formation of a local council in Nevada to co-operate with the National body, was read by C. W. Whitney. On motion of John J. Mullin, secretary of the Nevada Industrial Commission, a resolution was passed by the convention to the effect that it was the sense of the conference that an organ-

ization he formed to carry on the industrial safety work in Nevada and that Governor Oddie appoint a committee of nine of which he constitute the chairman to arrange for and perfect such an organization.

The conference proper closed with a banquet given by the Engineers' Club of the University to the delegates and guests. Regent A. A. Codd of the University presided as toastmaster and the speakers of the evening included Governor Oddie; W. S. Lunsford, city attorney, and Reno Typographical Union; Hon. P. A. McCarran, Justice Supreme Court; R. J. Clancy, assistant general manager Southern Pacific Railway; J. B. Brennan, representing the Blacksmith's Union; J. H. Linn of the Santa Fe, and Dr. J. E. Stubbs, president of the University of Nevada. Mr. Clancy's remarks were particularly interesting to the technical and railroad men present as they covered a wide range of the Southern Pacific's activities touching on the historical side and closing with the live subject of electric headlights.

Of the exhibits at the conference the principal one was that of the Southern Pacific Company, which reproduced the exhibit booth that was shown at the International Exposition of Safety and Sanitation held in New York City in December, at which time the company was awarded the Harriman Medal for the best safety record of all railways in the United States during 1913. The exhibit was in charge of John C. Weigandt, assistant chief clerk to Julius Krutschnitt, chairman executive committee Southern Pacific Company. Another very interesting exhibit was an electrically operated working model of the block signal system used on the Southern Pacific. The University of Nevada exhibited a small locomotive and gas engine and generator, constructed in the University shops, also a comprehensive display of "safety first" literature.

Much of the credit for the success of the conference is due to Professor Scrugham who conceived the idea of the meeting and arranged practically all its details, carrying it through with honor to himself, the University and the State.

ELECTRIC HEADLIGHTS.

BY J. G. SCRUGHAM.

Since the safety of the traveling public and of men engaged in the transportation industry is in a certain measure dependent upon the use of a proper headlight for cars or locomotives, it seems proper to discuss this important subject at an Industrial Safety Conference. Twenty-eight states have adopted legislation embodying seventeen different specifications regarding the use of headlights on locomotives. The enlightened state of Georgia requires a 300 watt arc lamp with a 23 in. reflector, while in the adjacent state of Mississippi, an 18 in. reflector is deemed necessary. In South Carolina the light must measure 10,000 candlepower with a reflector. Nebraska requires a light that is sufficiently strong to distinguish an object the size of a man at a distance of 600 ft. (Whether the man is to be a white man or a black man, dressed in white or black clothes, etc., is not specified.) In five states a similar law is enacted in which the distance is set at 800 ft. In Iowa it is made to specify discernment of a man lying down at a distance of 1100 ft. Several states require a light of 1500 candlepower without a reflector, while Missouri requires 1500 candlepower with the reflector. It will be noted that many of the above laws are of a conflicting character, especially as the strongest practicable headlight manufactured at present delivers less than 1000 mean spherical candlepower without a reflector.

What the traveling public, railroad management, and employes all want is that light which is most conducive to the safe operation of trains. The problem is how to obtain it. The efficiency of a headlight is primarily dependent on the reflector or lens used, and, secondarily on the volume or power of the light itself. The reflector may multiply the horizontal candlepower of the head lamp anywhere from unity to 2000 times or more, depending upon the condition of reflector and the focus used. For example, a 500 horizontal candlepower arc with a dirty, ill focused reflector, may give only a very few thousand candlepower ahead on the track, while a well designed 100 candlepower incandescent, with a properly focused reflector is capable of delivering nearly a quarter of a million candlepower where it is needed. To obtain efficient results it is necessary for the light source to be well concentrated and placed at what is known as the focal point of the reflector. The complaint about poor headlights arises as much from the improper condition of the reflector and focusing, as from the insufficiency of the light itself. There seems to be an almost unanimous opinion that the light reflected ahead should be of sufficient volume to enable the engineer to discern any serious obstruction or fault on the track in time to prevent or minimize the danger of an accident. This means that the object must become visible at a distance of from 500 to 1000 ft. under ordinary operating conditions. Another requirement is that the light should not be so strong and dazzling as to blind observers or approaching enginemen. A very powerful arc, especially those rich in greenish rays, should be avoided because of the tendency to give a false color to the red danger signals and the injury to the eyes of those looking into its field.

The light should be uniform, reliable, and easily replaced or repaired in case of failure. Our problem is to determine which light most nearly fulfills these conditions. In recent years the unit, called the candlepower, has been practically abandoned by illumination engineers and lamp manufacturers on account of its ambiguity. The most definite and useful unit is called the foot candle, and is a measure of the illumination on the objects to be made visible, instead of being a measure of the light source itself. To those having normal vision, an illumination of one-tenth of a candle-foot thrown from a headlight on a dark object the size of a man renders it distinctly visible at a distance of a thousand feet or more under ordinary conditions. A man wearing white clothes can be discerned at twice this distance. If he wears some glittering jewelry, as in one case which came under my observation, he can be spotted more than half a mile away. However, all trials should be based on discernment of dark objects, as the average trespasser on the right of way is rarely so accommodating as to display his jewelry to the engineer on the approaching train.

Illumination such as I have just described can readily be obtained from a concentrated filament lamp of 100 spherical candlepower if a well silvered parabolic reflector is used. In my opinion any stronger illumination is a waste of light. In foggy weather or when the air is filled with snow flakes, the lower candlepower lamp again has the advantage as the rays are more penetrating than those of the higher candlepower light. These latter are reflected back toward the observer. It is only within the past few months that a satisfactory incandescent lamp has been devel-

oped for headlight purposes. The old carbon filament lamp and the earlier forms of tungsten lamp were of such nature that the light source could not be sufficiently concentrated to give good results with a parabolic reflector. However, the development of the wire drawn helix filament tungsten lamp surrounded by nitrogen gas seems to have solved the problem. When a lamp is so constructed that practically all of the light source can be placed at the focal point, the illuminating efficiency is vastly higher than when the light covers a large area. For this reason a low candlepower lamp can frequently reflect a better light on the track than the large arc. The big headlight manufacturing concerns, such as the Pyle, Remy, and others, who formerly specialized in arcs are now building turbo-generator sets to accommodate the rapidly increasing demand for the incandescent light. The advantages of giving no fumes to blacken or tarnish a reflector and requiring no elaborate mechanism for adjustment is obvious to all. I hold no brief for any particular make or type of generating apparatus. The point I do wish to make is that a five hundred or a five thousand candlepower light is of very little use in preserving the lives of the traveling public unless it is properly reflected and directed to where it is needed. Another thing worthy of consideration is the location of the light on the front of the engine.

For many reasons it would be a marked advantage to have the headlight located lower down on the front of the boiler than is the present practice. I was formerly a very warm advocate of such a change, but after observing the ultra-coarse methods used by an Austrian helper in opening up a smoke box door with a sledge hammer, the desirability of the present headlight location became obvious.

Reverting to the subject of headlight legislation again. While the startling originality of the ideas of some of the bill framers might be deemed commendable, yet the question is obviously one that should receive the attention of some competent Federal Commission empowered to make recommendations to congress. Such a commission should consist of a number of locomotive engineers and other qualified experts who would determine what degree of illumination on an object expressed in foot candles is required for the engineer with normal vision to sight a man in dark clothes at various specified distances. All legislation should be based on such accurate and reliable information instead of in haphazard manner as at present.

Record of Tests.

The following summary of distance tests made with headlights, February 5, 1913:

In these tests the persons on the track were dressed in dark clothes. The column headed "as an obstacle" shows distance persons were visible as an obstruction of some kind on the track. The column headed "counted" shows distance when the number of persons on the track could be counted from the cab or discerned as a person.

Acetylene Standing Test.

Date	No. of men on track	As obstacle	Counted Ft.	Remarks.
7-26-11	1	799		
"	1		524	
"	1		734	
"	1		681	
"	1		563	
"	1		642	
	Average	799	642	
10-25-10	4	742		Commercial Acetylene Co. gas and reflector
"	4	768		
"	4	787		
"	1	831		
"	1	697		
	Average	765		
9-2-10	5	449		Commercial Acetylene gas and reflector.
"	5	481		
"	1	441		
	Average	457		
9-2-10	6	513		Commercial Acetylene reflector and S. P. generator.
"	6	597		
"	1	469		
	Average	526		
9-2-10	4	637		Commercial Acetylene reflector, S. P. Co.
"	4	645		
"	4	725		
"	4	705		
	Average	692		
9-2-10	5	637		Commercial Acetylene Co. reflector and S. P. generator.
"	1	661		Commercial Acetylene Co. gas and S. P. Co. reflector.
"	4	773		
"	4	773		
	Average	736		

Acetylene Running Test.

10-25-10	4	601		Commercial Acetylene Co. 6-in. reflector.
"	4	653		Commercial Acetylene Co. 6-in. reflector.
	Average	627		

Electric Incandescent, Standing Tests.

7-8-12	2	1057		Mazda light from General Electric Co.
"	1	1030		Mazda light from General Electric Co.
"	1	1030		Mazda light from General Electric Co.
"	2		960	Mazda light from General Electric Co.
"	3		960	Mazda light from General Electric Co.
"	3		960	Mazda light from General Electric Co.
9-11-12	2	674		Westinghouse zigzag filament.
"	2	674		Westinghouse zigzag filament.
"	2	674		Westinghouse zigzag filament.
"	1		590	Westinghouse zigzag filament.
"	2		640	Westinghouse zigzag filament.
9-11-12	2	780		Westinghouse U-shaped filament.
"	3	705		Westinghouse U-shaped filament.
"	1		690	Westinghouse U-shaped filament.

Running Tests.

7-8-12	2	990		Mazda light from General Electric Company.
"	1	852		Mazda light from General Electric Company.
9-11-12	3	621		Westinghouse zigzag filament.
"	2	780		Westinghouse zigzag filament.
"	1		690	Westinghouse zigzag filament.
"	3	705		Westinghouse zigzag filament.

Electric Arc, Standing Test.

Date.	No. of men on track visible as obstacles.	No. of men on track counted.	Distance, ft. No. 1.	No. 2.	Remarks.
8-2-12		1	1067	1217	No. 1 Lacy light.
"		1	1109	1137	No. 2 Pyle light.
"		1	1148	1073	
	Average		1108	1142	
8-2-12	1		1608	1617	
"	1		1568	1561	
"	1			1601	
	Average		1588	1593	

Date.	No. of men.	As obstacle.	Counted.	Remarks.
8-2-11	1	1420		Lacy headlight.
"	1	871		Lacy headlight.
	Average	1146		Lacy headlight.
8-2-11	1	1041		Pyle headlight.
"	2	1169		Pyle headlight.
	Average	1105		

The last two tests are electric arc running tests.

Summary.	Feet.
Acetylene standing test	653
Acetylene running test	621
Acetylene, all tests	650
Electric arc standing test	1281
Electric arc running test	1125
Electric incandescent, General Electric Co. Standing test	1000
Electric incandescent, General Electric Co., running test	921
Electric incandescent, Westinghouse zigzag filament, standing test	650
Electric incandescent, Westinghouse zigzag filament, running test	621
Electric incandescent, Westinghouse U-shaped filament, standing test	725
Electric incandescent, Westinghouse U-shaped filament, running test	725

In test of Westinghouse incandescent the zigzag filament light tested had been in service 55 hours of light; the U-shaped filament tried was new.

Relative to oil light, we have no tests made under the same conditions as above.

A test made at Benali in 1907 noting the distance another engine (without lights) could be seen gave the relative distances for oil and acetylene as 1 to 2.18.

On this basis one or more people would be visible on the track with an oil light at a distance of 300 ft.

General comparison as follows using the standing test and in the incandescent light the higher candlepower, General Electric only:

	Feet.	Relative distance.
Oil light	300	1.00
Acetylene	653	2.18
Electric incandescent	1000	3.33
Electric arc	1281	4.27

Engine 3017—Aug. 8, 1913.

This lamp is a General Electric Incandescent Tungsten having nitrogen in bulb. It is operated by Exide Storage batteries made by Electric Storage Battery Company, Philadelphia, Pennsylvania.

Batteries arranged 2 sets in multiple 4 batteries in series in each set, a rheostat is used and the circuit shows 8 volts and 12 amperes, 6 volts across the lamp which consumes 72 watts and is rated at about 100 candlepower.

Test was made of light on Sacramento Southern on morning of August 7th, between hours of 1 and 3:30 a. m. Night clear and dark; moon absent; men on track dressed in dark clothes.

Globe tested had been in service approximately 5 hours, light being applied at Oakland August 6th for run Oakland to Sacramento, train No. 16.

Result of distance tests as follows:

Men on Track Discerned as Object or Obstruction of Some Kind.

No. of test.	No. of men on track.	Distance, ft.
1	3	1099
2	3	993
3	3	1079
	Average	1057
	No. of men on track counted.	
1	1	857
2	2	751
3	1	917
	Average	842

Running Test—Engineer and Fireman Only Taking Part—Distance Men on Track Discovered as an Object or Obstruction of Some Kind.

No. of test.	No. of men on track.	Distance, ft.
1	3	791
2	2	766
3	2	1038
	Average	865

Pyle National Incandescent Headlight—November 15, 1913.

This generator (Type "S" Turbo-Generator Unit) has been installed for trial on engine No. 2328, furnishing current for a 20 watt 32 volt Westinghouse Mazda incandescent headlight lamp.

Roundhouse Test of Type "S" Generator.

Test.	Steam pressure.	Revs.	Volts.	Headlight, Amps.	Watts.	Auxiliary lights, cab and markers.	Approx. total watts.	Steam, per hr., lb.	Steam per kw. hr., lb.
1	198	3642	30.7	3⅛	96	5	255	106	416
2	198	3578	30.5	3	91.5	None	91.5	90	984
3	198	3727	29	00	00	None	00	74	...
4	198	3549	29.5	3	88.5	4—1	328	119	363

In test No. 4 one of the Westinghouse headlight lamps was put in place of one of the Marker lights in order to note operation of generator with a little overload.

Steam used per hour by type "S" in operating headlight alone in comparison with type "C" which is most in use and with the later compound wound type "E" as follows:

Steam lb. used per hour.

Type "S"	90 lb.	Test above.
Type "E"	215 lb.	Test by Pyle Co.
Type "C"	421 lb.	Test report of Dec. 16, 1912

The type "S" turbo-generator is a small compact unit, its weight compared with types "E" and "C" as follows: Type "S," 125 lb.; type "E," 290 lb.; type "C," 350 lb.

It operates satisfactorily in round house test and in road service is easy to regulate and entirely closed in and protected from sand and dirt and appears to be a satisfactory generator for the low current required by the tungsten incandescent lights.

Distance test of the 120 watt 32 volt incandescent used in above test was reported September 30, 1913, as follows: Three men on track observed as obstruction of some kind, 1149 ft; 1 to 3 men on track counted from cab, 854 ft. Running test, approximately 30 m.p.h., 3 men on track observed as obstruction of some kind 976 ft.

Discussion.

Many of the views expressed by Prof. Scrugham were approved by Howard Stillman, chief mechanical engineer for the Southern Pacific Company. He did not approve of too much brilliancy in electric headlights and was opposed to the plan of dropping the headlight to the center of the engine. He earnestly looked for federal legislation upon this subject and declared the railroads would greatly appreciate a uniform law upon the subject.

"The essential feature of the electric headlight is the certain amount of brilliancy upon a certain object, and both brilliancy and object should be specifically agreed upon before additional legislation is enacted," declared A. H. Babcock, chief electrical engineer of the Southern Pacific Company. The necessary points to consider in the source of the light was the reflecting surface and the type of lamp. One of the disadvantages of the arc lamp was the travel of the arc. The beam was not steady and a variation of the arc by 1/16 in. was apt to throw the beam wide of the track. Another disadvantage was the clouding of the reflector. With an incandescent lamp such as the nitrogen filled lamp, the beam was a constant and penetrating one and it could be accurately focussed on the point desired. The matter of power supply could be taken care of either by a turbo-generator or storage battery—the latter having many advantages. It would only be necessary to supply a battery of capacity sufficient to carry the light over any emergency.

Frank Ingram, secretary of the Brotherhood of Locomotive Firemen, had ideas of his own when it came to tampering with headlights. At present he was satisfied with the arc headlight and would prefer to stay with that type until others had been experimented upon and demonstrated to be of

superior grade. Brilliancy was his idea in a light and the more illumination the better. The Nevada laws called for a light generating 1500 candlepower, and as this was the standard in 11 other states, he believed national legislation should be enacted containing a like provision. Ingram declared that at the last convention of his brotherhood the president had been instructed to take the matter up with congress in the hope of securing a federal law.

R. Holland, a locomotive engineer on the Sacramento division of the Southern Pacific line, did not agree with Ingram and declared that too much brilliancy was a detriment, instead of aiding the men in the cab, and cited several instances wherein people had been blinded temporarily by lights that were exceedingly brilliant. The variance of the laws now on the statutes in the different states was serving to retard the railroads in adopting a headlight of uniform brilliancy, declared Holland and as soon as a uniform law was secured he predicted that every road would hasten to meet the requirements.

The use of electric headlights had served to reduce accidents on railroads, according to R. B. Stowe, assistant master mechanic of the Southern Pacific. He declared when the electric lights was first brought out, eight were placed in use on the Southern Pacific. Then came orders to install 100 lights on locomotives and the results were watched with interest by both trainmen and railroad officials. Shortly afterwards 800 electric lights were in use and it was not long until the entire system had underwent a complete change from the old oil lamps.

O. Kearns, a locomotive engineer on the Sacramento division of the Southern Pacific, indulged in reminiscences regarding the old oil headlight.

"I started my railroad career as a callboy," said Mr. Kearns, "and at that time the engineers were attached to certain engines. All took a pride in their lamps and would spend spare time polishing the reflectors. It was two years before I was even permitted to light a headlight and considerably longer before the engineers would permit me to trim the wick." Kearns favored the arc light instead of the incandescent, stating that in a wind storm, when the glass shield was broken the arc would continue to do duty.

The new nitrogen lamp was favored by A. C. Myers, assistant electrical engineer of the Southern Pacific, providing the light could be held on the track and object, without the jumping as is now experienced in the arc light. Myers also said that the incandescent lamp has many features and advantages over the arc lamp.

R. H. Bishop, representing the Brotherhood of Locomotive Firemen, said that a good light was needed and was in favor of adopting legislation to secure a uniform law on the question. He preferred the arc to the incandescent lamp, and stated that with the use of the incandescent it might be necessary to return to the old custom, for with the breaking of the lamp a white lantern might be pressed into use, which was next to nothing when brilliancy was concerned.

Excessive brilliancy was dangerous, according to the opinion as voiced by A. M. Meston, air brake expert of the Southern Pacific, who said that an exceptionally bright light would serve to confuse signals. He called the attention of the delegates to the mass of signals and signal towers in use at the Oakland mole. The eyes would become affected by the extra brilliancy and it would be an easy matter to confuse the colorings of the green and red lamps. Mr. Meston was the last to participate in the headlight discussion.

Headlight Tests.

After the close of the conference on Tuesday evening a special train was provided for the guests and officials and a very interesting series of tests was made of electric headlights on the Southern Pacific tracks at a point near Laughton's Springs about five miles west of Reno. The test was very conclusive in demonstrating that the low candlepower nitrogen lamp was far more effective than the arc. The nitrogen lamp used was a 120 candlepower lamp of General Electric manufacture, that had been used about 400 hours. It threw a sharp, steady, penetrating beam without flicker or glare. By it, objects were picked up from one and four-fifths to two and a half times as far as by the arc lamp.

Engine 3019, equipped with the nitrogen lamp and engine 2320, equipped with a Pyle National arc lamp, were used in the tests. In the standing test, the obstruction (three men dressed in black clothing), were picked up at 1160 ft. with the aid of the arc lamp. The nitrogen lamp picked the men up at a distance of 1900 feet.

In one running test the arc lamp picked up the obstruction at 674 ft. while the nitrogen lamp picked up the object at 1508 ft. In the other running test the arc lamp picked up the object at 860 ft. and the nitrogen lamp at 1606 ft.

The tests were conducted under the supervision of Prof. James G. Scrugham and Governor Oddie. The Southern Pacific officials present included R. J. Clancy, assistant general manager; A. H. Babcock, electrical engineer; Howard Stillman, mechanical engineer; Norman Collyer and A. C. Myers. Among the representatives of the trainmen who conducted the tests were Legislative Agent Bishop of California; O. Kearns, chairman of the grievance committee; W. E. Wallace, member of the Nevada Industrial Insurance Commission and legislative representative in Nevada, and Frank Ingram of Sparks, who, as secretary of the Brotherhood of Locomotive Firemen, read a paper before the afternoon conference, advocating the higher power arc lamps.

At the conclusion of the test the trainmen who had been so strongly in favor of the arc light, expressed themselves in favor of the new nitrogen lamps and stated that they would like to see them installed as soon as possible.

Nevada's law requires a 1500 candlepower headlight, and from present indications, the trainmen who secured its passage will probably ask its repeal at the next session of the legislature so that the smaller, but more efficient lamp, may be introduced in its place.

Concrete poles reinforced with ⅜ in. bars have been commercially made in Canada at a total cost of less than five dollars each for 24 ft. poles with 8 in. base and 5 in. top and of less than eight dollars for 30 ft. poles with 8 in. base and 5 in. top, including steel cross-arms and iron conduit pipe.

The extensive use of poles for overhead distribution is emphasized by the fact that in the United States there are, over eight hundred thousand miles of pole lines. There are in service today over thirty-two million poles. The annual renewal requirements are over four million, and of these large totals it is claimed over sixty-five per cent are cedar.

Low rates for electric heating are possible in several Western states where large amounts of hydro-electric power are used for irrigation pumping during the summer months. During the winter a large surplus generating capacity would ordinarily not be used but by charging just enough to maintain the extra distributing capacity it is possible to thus popularize the use of electricity. At Visalia, Cal., the Mt. Whitney Power & Electric Company makes a charge of 10½c per kw.-hr. for the first 20 kw., 3½c for the next 150, and the balance at 1c with a 15 per cent discount for prompt payment each month. At Twin Falls, Idaho, the rate is $16 per kw. season in 10 kw. quantity, this being sufficient to heat a 5-room house.

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Industrial Safety Conference

Considerable credit is due the University of Nevada for their praiseworthy part in inaugurating the industrial safety conference, which has just been brought to so successful an issue at Reno. The impetus given to the "safety first" movement should be far reaching, as each of those who attended will return to his own center of activities to there further promulgate that spirit which prompted the conference. Safety First!

Perhaps the most important subject discussed was that of locomotive headlights. At the present time there is an extreme lack of uniformity on the statute books of the different states as to what constitutes a legally "safe" headlight. Moreover the wording of the various laws is often in ambiguous non-technical language and not as definite in any case as progress along the line of illumination engineering as applied to locomotive headlights, would permit.

The information brought out by the presentation of Prof. J. G. Scrugham's paper on this subject, the discussion and the test made, all form a basis for the removal from the statutes of the present generally unsatisfactory headlight laws and the enactment of those satisfactory to transportation companies, their employes—more particularly the engine drivers—and to the travelling public.

The radical changes possible are due to the use of the new nitrogen filled lamp which permits greater control of the light flux so that better illumination of distant objects is obtained.

An aphorism expressive of one phase of the safety first idea is, that it is better to cause a delay than an accident. While in some matters it is advisable to make haste slowly, yet with the way opened up for the adoption of the more scientific, more satisfactory and safe method, it would be better far to heed the adage, Delays are dangerous.

Safe Railroad Travel

The Southern Pacific Company was awarded the Harriman Memorial Safety Medal by the American Museum of Safety. This medal is evidence of the best record of accident prevention throughout the year 1913, of all the steam railroads in the United States.

Had the time been extended to cover five years the same company would undoubtedly have still occupied first place, for during that period just past, not one passenger's life has been lost through the collision or derailment of trains on their line.

When it is realized that this record covers the remarkable total of eight thousand million passenger-miles, it will be evident that the impossible may always be attained.

At the Reno industrial safety conference it was brought out that not more than one-third of the reduction in accidents which has taken place, is due to the use of safety appliances but that two-thirds of these reductions were due to the education of employes; through getting into touch with the workmen, and securing their co-operation.

That the Southern Pacific Company has taken both factors into consideration was borne out by significant statements also made at that time. This com-

pany's safety work has cost for automatic block signals, $3,400,000; for interlocking block signal plants, $1,500,000; for crossing signal systems, $1,400,000, and $262,000,000 in ten years for all purposes.

But to ensure the successful use of these, education of the employe was essential. That the company equally considered this phase was brought out by the remarkable record of tests made. Three thousand one hundred and ninety-four surprise tests in 1913 showed a safety percentage of 99.56 over six thousand three hundred miles of trackage, while another set of two thousand two hundred and eighty-six surprise tests showed one hundred per cent efficiency.

It can be done. The travelling public may be adequately protected. But probably before this absolutely safe period of travel over all lines arrives, the public will need to be educated to a realization of the important factor which they themselves are, and be willing to pay the piper in order to have the certain assurance of safe travel.

The Silver Lining

The old-time ominous cloud overhanging the hydroelectric development of the West has shown signs of breaking. During the past few days the rift has widened further, showing the proverbial lining of even greater promise. To the West this is gratifying.

This journal has always been the advocate of a sane conservation, that is to say, a wise use of water power with adequate protection to all interests, and absolutely opposed to any withdrawal methods which would in any way tend to throttle industry or to deprive the people of the advantages due to development.

The public's educated fearfulness which first hindered full and continuous development of water power sites, had its inception at a time when the conservation of all natural resources, renewable, as well as those which with time can never be renewed was being advocated. This resulted unfortunately for the public, for the opposite to the desired result was achieved.

Where development of water power was halted, non-renewable fuels had instead to be used for the generation of needed power. It was the same result which always obtains when the substance is lost in the grab after the shadow.

The water loses nothing by its use for power purposes, neither is the power conserved by non-development. It must be either utilized or allowed to run to a worthless waste.

A stoppage of this enormous waste is possible only by giving to the people and industries of the several states in which these water power sites are to be found, a cheap and bountiful power supply.

Latterly the Forest Service which has had control of hydroelectric development in the West, due to the fact that the principal undeveloped water power of the country is to be found on Forest Reserves, has been better disposed toward the idea of complete development, but the unwieldy regulations of that department still leaves much to be desired.

The Federal government may also still exact a rental, that is, a taxation, for the development of water power sites, but with the now more efficient commission control there is but little excuse for this provision to continue.

This is especially true too in view of President Wilson's statement anent the California Alien Land Law in its bearing upon Japanese immigration that "the Federal Government cannot under the constitution dictate to a state what its land laws should contain."

Coincident with the issuance of this statement the supreme court of California rendered a decision regarding reserve lands, the gist of which was that it is a departure from the accepted construction of constitutional provisions, for the Federal government to withdraw from state use, one-third the area of a sovereign state, as is the case in California, forever deny to the state the sovereign power of control over these lands, and develop and exploit them under its own rules and regulations for the enrichment of its own treasury.

The light thrown on the subject of hydroelectric development by this dual interpretation of the law, minimizes the power of those influences deterrent to development, and brightens the outlook with a bow of added assurance.

Federal Telephone Ownership

The expected statement from the Postmaster General advocating government ownership of all means electrical for the transmission of intelligence, was made during the past week in a report which was submitted to the United States Senate. The report was in response to a resolution asking that he make an investigation of the subject as an extension of the postal service.

Ownership of the telephone lines is advocated for the reason that telegraph service may more readily be super-imposed upon telephone lines than vice versa. It is concluded that it would be unwise for the government, from a commercial point of view, to acquire by purchase, the telegraph lines. The telegraph business is on the wane, speaking comparatively and competitively.

The cost of acquiring the telegraph facilities is estimated at two hundred and twenty-five million dollars and of the telephone long distance and toll lines, two hundred million dollars.

Present reports do not give any further essential details. The method in which it is proposed to operate these apparently inevitable government owned telephone lines is of great importance to all, for any dis-ease in this nervous system of the nation's life would prove disastrous.

A central control too remote from the extremes of the system might also prove a disadvantage.

A possible solution of this new problem will be found in state ownership of long distance lines with interstate co-operation on the part of the Federal Government, and municipal or private ownership of local systems, for the American people are not ready for any very radical changes along this line.

Whatever the method followed it will be many years before a complete adjustment to such a change can be conveniently effected.

Developments will be followed with interest.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

Sidney Sprout, consulting engineer, San Francisco, has returned from the East.

Frank Fowden, Brooks-Follis Electrical Corporation, was at Sacramento last week.

J. O. Presbey, Holophane Works of General Electric Company, is at Denver.

J. E. Leavitt is now manager of the Portland office of the Van Emon Elevator Company.

Andrew Carrigan, of Dunham, Carrigan & Hayden, has returned to San Francisco from Chicago.

F. H. Whipple, owner F. W. Whipple Machinery Company, Visalia, Cal., was at San Francisco last week.

Geo. R. Murphy, of the Pierson-Roeding Company, was at Los Angeles on business during the past week.

O. F. Swenson, salesman, with Hunt, Mirk & Company, is at San Francisco, having returned from Washington.

C. V. Schneider, president Electrical Supply Company, Sacramento, was at San Francisco during the past week.

J. A. Ulmer, president, J. Ulmer Machinery Company, Porterville, Cal., was a visitor at San Francisco during last week.

Al Sprout, electrical engineer, California-Oregon Power Company, was at San Francisco from Yreka during this week.

L. S. Twomey, superintendent Oakland Lamp Works, was recently elected a member of the Illuminating Engineering Society.

H. C. Goldrick, Pacific Coast manager, Kellogg Switchboard & Supply Company, has returned to San Francisco from the East.

Elmer Dover, vice-president of H. M. Byllesby & Company, is at present in the East, but expects to return to Seattle at an early date.

K. G. Dunn, vice-president, Hunt, Mirk & Company, San Francisco, has returned from a business trip made throughout Southern California.

J. F. Walters is now president of the California Electrical Supply Company, vice **R. L. Wolden**, who has disposed of his interests in the business.

John Harisberger, superintendent of transmission, Puget Sound Traction, Light & Power Company, Seattle, is spending two weeks at Los Angeles.

George C. Cooke, of the American Cross Arm Company, spent several days in Seattle this week, returning to Centralia, Wash., on Thursday.

W. C. Johnson, resident salesman, Westinghouse Electric & Manufacturing Company, Bakersfield, is at San Francisco; also **W. E. Lee**, resident salesman at Fresno, Cal.

Sylvester M. Baker, Macbeth Evans Glass Company, was, on account of a severe cold, compelled to curtail his Southern California business trip and has returned to San Francisco.

Thos. A. Edison, who is still actively engaged in the development of the electrical industry, passes the 67th milestone next week, having been born at Milan, Ohio, on February 11. 1847.

A. B. Mann, manager refrigeration machinery department, H. W. Johns-Manville Company, San Francisco, has left for Fort Wayne, Ind., where he will visit the Fort Wayne Works of General Electric Company.

Prof. J. G. Scrugham, Hal Lemmon and **F. O. Broili**, all of Reno, were named a committee to consider "safety first" questions in Nevada, at the recent industrial safety conference held at the Universityo of Nevada.

W. E. Herring, industrial agent, Puget Sound Traction, Light & Power Company, recently delivered an address on the power situation in the northwest before the supervisors of the United States Forestry Service.

Herman Bamberger, vice-president of the Salt Lake and Ogden Railroad Company, the Bamberger electric line to Ogden, is representing his company at the midwinter convention of the American Electric Railway Association in New York.

W. J. Grambs, superintendent of light and power for the Puget Sound Traction, Light & Power Company, has been promoted to the position of assistant to the president. **Geo. E. Quinan**, operating superintendent of the company, will succeed Mr. Grambs as superintendent of light and power.

F. M. Sammis, chief engineer, The Marconi Wireless Telegraph Company, New York, and **J. R. Irwin** of Seattle, superintendent of the North Pacific district were at Astoria, Oregon, during the past week negotiating for a site upon which the company intends to erect one of the largest wireless stations on the Pacific Coast.

John L. Timmins has returned to Fairbanks, Alaska, from the Totatlanika country. His company, the Tanana Gold Fields Mining Company, expects to instal a power plant in the Nenana Goldfields region with the idea of supplying its properties in the Fairbanks district. Preliminary survey work will be done next March.

H. F. Holland, representative of the Simplex Electric Heating Company in the intermountain district, has returned from his midwinter trip to the factory at Boston. He reports that the activity shown in electrical appliances, and particularly electric cooking appliances, is greater in his territory than in any other served by his company.

D. C. Henney was appointed chairman and **H. B. Hastings** and **T. D. Weber**, as members of the committee appointed by the Oregon Society of Engineers, at the instigation of the Civil Service Commission of Portland, Oregon, to draft examination questions for the test of those candidates who apply for positions with the city, in which technical training is required.

S. C. Haver Jr., Southern California Edison Company, has been transferred from assistant agent at Long Beach, to the position of collection agent, with office in the Edison Building. **George B. Simpson**, formerly chief clerk in general agent's office, has been transferred to Long Beach district as assistant agent, and **J. Harry Peiper**, engineer of illumination and vehicles, in addition to his other duties, will assist in handling correspondence and other matters in the general agent's office.

Dr. F. J. H. Merrill, secretary American Institute of Mining Engineers, has been appointed chairman of a committee appointed at Los Angeles to arrange for joint engineering headquarters in that city. The other members of the committee are: **Fernand Parmentier**, secretary Southern California Chapter, American Institute of Architects; **C. G. Pyle**, secretary Los Angeles Section, American Institute of Electrical Engineers; **W. K. Barnard**, secretary, Los Angeles Branch, American Society of Civil Engineers; **Walter L. Jordon**, secretary, Southern California Section, American Chemical Society; **G. M. Swindell**, secretary Chamber of Mines and Oil, and **H. Z. Osborne Jr.**, secretary, Los Angeles Engineers' and Architects' Association, who is secretary of this committee also.

MEETING NOTICES.

Oregon Electrical Contractors' Association.

The regular monthly meeting of the Oregon Electrical Contractors' Association took place at the Portland Commercial Club on Wednesday evening, January 28th at 6:30 p. m. At this meeting certain constitutional amendments were considered, and some features of the new electrical ordinance were discussed.

Oregon Society of Engineers.

The third annual dinner and business meeting of the Oregon Society of Engineers was held in the blue room of the Multnomah Hotel, Portland, Oregon, on Monday, February 2d, at 6:30 p. m. A number of ladies were present. The two principal speakers were: W. E. Coman, vice-president and general manager of the Northwest Electric Company, and Franklin T.

Griffith, president Portland Railway, Light & Power Company. There was a good attendance.

Electrical Development and Jovian League.

An enthusiastic meeting was held after the regular luncheon at Tait's last Tuesday for the main purpose of electing Jovian officers. Under great pressure, Mr. A. E. Rowe was persuaded to continue the good work which he has started and was re-elected Statesman.

The Hawaiian Band was present and rendered several selections. Mr. A. C. Taylor, agent Hawaiian Promotion Committee, also gave an interesting talk on Hawaii, which was illustrated with lantern slides.

Joint Meeting Portland Section, A. I. E. E. and N. E. L. A.

The February meeting which was well attended, was held on the 3d inst., at the Hawthorne building, Hawthorne avenue and Water street, at 8 p. m., at which L. F. Harza presented a paper on "New and Proposed Regulations Affecting Water Power Development." C. A. Huggins, secretary and treasurer, Portland Railway, Light & Power Company, presented Mr. R. D. Mershon's paper on "Some Things Engineers Should Know Concerning the Rudiments of Corporate Finance," which was also discussed.

The dancing party given by A. I. E. E. and the N. E. L. A. local sections at the Multnomah Hotel on the evening of January 27th was a huge success. The party was attended by 75 couples and every one present had a most delightful time. The program committee provided an opportunity for the graphic representation of single-phase (one-step), two-phase (two-step), and three-phase (three-step) curves. Everyone present agreed that engineers should be given more opportunities to make these graphic diagrams.

Proposed Engineers' Headquarters at Los Angeles.

A meeting of the officers of various technical societies was held at the Hollenbeck Hotel on Friday, January 30th, with a view to arranging for joint engineering headquarters in Los Angeles. A committee was appointed, which includes the secretaries of all such organizations having local representation. Dr. F. J. H. Merrill, secretary of the American Institute of Mining Engineers, Los Angeles Section, was appointed chairman, and H. Z. Osborne, Jr., secretary of the Engineers' and Architects' Association, secretary.

Jovian Electrical League of Southern California.

The Jovian Electrical League of Southern California held its weekly luncheon at Christopher's on Wednesday, the 28th instant, with F. S. Schuyler as chairman of the day. Rev. Baker P. Lee delivered a most interesting sermon, taking as his subject "Wireless Flashes." The Reverend Mr. Lee is a pastmaster in putting old truths in a new form, and it is doubtful if the League ever listened to a more interesting talk. There was an attendance of about 120 members and visitors. Next week the League will be the guest of the John A. Roebling's Sons Company, at their new factory, 216 South Alameda street.

Los Angeles Section A. I. E. E.

The Section held its regular meeting at Blanchard Hall on Tuesday evening, January 20th. P. E. Taylor presented a paper on "The Electrical Precipitation of Dust from Rotary Cement Kilns." R. H. Manahan, Walter A. Schmidt, H. M. Mosher and J. A. Lighthipe participated in the discussion, also Wesley Beach, an attorney, who gave some interesting information leading up to the necessity for devising means of overcoming the damage to agricultural interests on account of the cement dust. A communication on the subject from Harris J. Ryan was read by T. A. Panter. There was an attendance of 76 members and visitors.

The Society for Electrical Development.

The board of directors of the Society for Electrical Development held a meeting at the Society's headquarters, 29 West 39th street, New York City on January 26, 1914. A considerable number of important matters were thoroughly discussed. Reports of J. M. Wakeman, general manager, and Stephen L. Coles, acting secretary-treasurer, which covered the operations of the Society up to date, were read and accepted. Stephen L. Coles, who has been acting secretary-treasurer of the Society for the past six months, was elected secretary-treasurer. Fifteen of the board of directors were in attendance. The meeting adjourned to February 17th.

Seattle Jovian League.

The regular meeting of the Jovians was held Friday, January 30th at the Rathskeller Cafe. Several communications were read. The after-dinner speaker was S. F. Rathbum of the Dexter-Horton Bank, who spoke at length on the opportunities which will be presented with the passage of the Alaska Railway Bill.

Mr. Rathbum's talk was general. He described the topography of Alaska and the rainfall at various districts to show the possibilities of developing water power.

Mr. Rathbum is one of the leading financiers of the North Pacific territory and has made an extensive study of conditions in Alaska, realizing that this new development of its resources will be of great benefit to the Puget Sound territory.

Utah Electric Club.

The regular weekly luncheon of the Utah Electric Club was held at the Commercial Club, Salt Lake City, Thursday, January 29th.

The entertainment committee reported in favor of a smoker and athletic tournament to be held Thursday evening, February 12th, and the committee was empowered to go ahead and make arrangements for the event.

L. N. Perrine, chief engineer of the Shoshone & Twin Falls Railway Company, gave a short description of that company's plants and cordially invited the members of the Electric Club to visit the Falls whenever it was convenient.

The talk of the day was made by Mr. Dorsey A. Lyon, metallurgist for the U. S. Bureau of Mines, located at the University of Utah. Mr. Lyon gave a brief outline of the work of the Bureau of Mines and its relation to the mining industry in Utah.

Utah Electric Light & Railway Company Section, N. E. L. A.

The regular meeting of the Utah Electric Light & Railway Company section of the National Electric Light Association was held at the company offices Wednesday, January 28th. J. Harry Tempest, vice-president, presided.

The question of omitting the February dinner of the Section and combining it with a half-day outing at Pine-crest, the new hotel and summer resort at the head of Emigration Canyon, was referred to the executive committee for decision.

Bayard W. Mendenhall, commercial agent, presented the paper of the evening on the subject, "The Trend of Electric Rates," in which he outlined briefly the history of electric rates, the factors which have entered into their evolution, and the trend of the rates as indicated by some of the more recent ones adopted, and by the rulings of state commissions.

A vigorous discussion followed in which practically all of those present participated.

Alameda County Electrical Development League.

The Alameda County Electrical Development League held its monthly meeting Saturday afternoon, January 31, 1914, at the Avenue Restaurant. The meeting was well attended, 50 members being present and composed of representatives of the power companies, jobbers, dealers, contractors and lighting fixture dealers, wiring contractors and jobbers par- League is to improve the quality of electrical work being done and so give the consumer the best possible installation and service. The latest devices are discussed and a general educational campaign is being carried on. Geo. B. Furniss of

the Pacific Gas & Electric Company, Oakland, is president, and Geo. G. Drew of the Pacific States Electric Company, Oakland, secretary.

The most important matter brought up at the last meeting was the hanging of lighting fixtures; who this should be done by, and the cost factors to be considered. Representative lighting fixture dealers and wiring contractors and jobbers participated and a committee was appointed to report further on the subject.

American Society of Civil Engineers.

The Portland Association of the American Society of Civil Engineers, at its monthly banquet at the Commercial Club, Portland, Oregon, on Tuesday, January 27th, heard a paper on the Celilo Canal read by F. C. Schubert, assistant Federal engineer. who has been prominently identified with the work since the inception of the project in 1905. Mr. Schubert made the final location following the preliminary activity and designed the work.

"This government canal," he said, "is designed to surmount the only barrier remaining, since the completion of the Cascades Canal 45 miles below, to continuous navigation of the Columbia River from the Pacific Ocean to Priest Rapids, Washington, a distance of 407 miles. The Celilo Canal is eight and one-half miles in length and has a bottom width of 65 ft., with a navigable depth at low water of 8 ft. It is to have four locks and will overcome four natural obstructions. The canal will be in operation from 9 to 11 months of the year, depending upon the severity of the June freshets and upon the presence or lack of ice in the river."

The project is 76 per cent completed, Mr. Schubert, estimates, and will be open for traffic by January 1, 1915, providing funds for the completion of the work are made available by congress at its present session.

In the absence of E. G. Hopson, president of the association, W. S. Turner, vice-president, presided.

Valentine Dance at Portland.

The General Electric Company and affiliated interests at Portland, Oregon, have arranged for an invitational dance for their employes and their friends, to be held on Saturday evening, February 14th, at the Hotel Multnomah. It is to be a Valentine dance and "no flowers" are requested. The committee in charge is: H. P. Cramer, E. A. West, Geo. A. Boring, A. M. Sherwood Jr., F. L. Whipple, W. R. Bagnall.

NEW CATALOGUES.

(Under this heading attention is directed to catalogues and bulletins representing the latest information upon the subjects treated. The latest developments are always in advance of the most up-to-date text books. Readers are urged to write direct to the publishers for these catalogues and bulletins, which, unless otherwise stated, are available for free distribution.)

Fourth Biennial Report of Oregon State Engineer, by John H. Lewis, Salem, Oregon; 90 pp., 6x9; 4 maps; numerous illustrations.

Mineral Resources of the United States, 1912; Part II; Non-Metals; 1218 pp.; 6x9; U. S. Geological Survey, Washington, D. C.

Water Supply Paper 337. The Effects of Ice on Stream Flow, by W. G. Hoyt; 1913; 77 pages; 7 plates; 18 text figures; U. S. Geological Survey, Washington, D. C.

Automobile Lighting and Battery Charging with the Holtzer-Cabot Magneto Generator is the subject of an attractive 12-page pamphlet from the Holtzer-Cabot Electric Company of Brookline, Mass.

Copper Wire Tables, Circular No. 31; U. S. Bureau of Standards, Washington, D. C.; 69 pp.; 7x10. Prepared at the request of the A. I. E. E. Standards Committee. Complete tables and explanations.

Wind Resistance of Steam Turbine Wheels, by Edgar Buckingham, U. S. Bureau of Standards, Washington, D. C.; 40 pp.; 7x10; a critical study of the experimental data which have been published and of equations for representing them.

The General Electric Company has just issued Bulletin No. A4199, which illustrates and describes that company's Railway Motor Gears and Pinions. It contains curves and data which will be of especial interest to purchasers of this material.

"Scientific Gas Rates" is the subject of an interesting pamphlet being distributed by Henry I. Lea, consulting gas engineer, Peoples Gas Building, Chicago, wherein it is ably contended that gas companies should equip themselves with facts to convince courts and commissions that their rates are on an economically sound basis.

The General Electric Company is just distributing its annual catalogue A-4197 of Electric Fans. This catalogue illustrates and describes the company's line of fans for the season of 1914, for table, wall and ceiling mounting, and describes also small ventilating outfits, fans which are moistureproof and have fittings which are non-corrosive, for use especially on ship-board.

Circular W M 509 has been issued by the Westinghouse Machine Company, which deals very thoroughly with the application of low pressure turbines. Circular W M 510 issued by the same company, describes that company's 1 kw. general utility turbine driven lighting outfits and the application of same. Dimension and construction details are given. The bulletins may be secured by addressing the Pacific Coast representatives of the company, Hunt, Mirk & Company, Inc., engineers and contractors, San Francisco.

"Pelton Water Wheels, Turbine and Tangential," is the subject of a valuable 100-page publication now being distributed to interested parties by The Pelton Water Wheel Company of San Francisco and New York. While this text is nominally only illustrative of the "Pelton type of design" of tangential and turbine wheels, gate valves, nozzles, governors, pipe-lines and pumps, it is in reality a practical handbook on modern hydraulic power practice. The purpose, design and typical installation of each type of apparatus is concisely stated in interesting text and beautifully illustrated by means of fine half-tones, paper and press work. The pictures include examples of many actual installations not heretofore described elsewhere. Tangential water wheel tables have been computed to show the maximum power that may be efficiently developed by tangential wheels of various diameters under different heads.

TRADE NOTES.

The Seattle, Wash., Board of Public Works, has awarded a contract to Pierson, Roeding Company for 57,096 lb. of weatherproof feeder cable.

The Pierce-Tomilson Electrical Company installed the electrical equipment in the Portland auto show which is now in progress at the armory.

The Dock Commission of Portland, Oregon, has nearly completed electrical specifications for Unit No. 1 of the Municipal Dock and bids will be called for soon.

The contract for installing the ornamental street lighting system on Metcalf street, Sedro-Woolley, Wash., was awarded to the Pacific Northwest Traction Company for $2170.78.

H. B. Squires Company of San Francisco and Portland, electrical manufacturers' agents, have taken over the additional territory of the Cutler-Hammer Manufacturing Company in Southern California, and in view of this fact have opened an office in the San Fernando Building, Los Angeles, to handle the Cutler-Hammer and their other lines. Mr. C. W. Yerger, who has been connected with the engineering department of The Cutler-Hammer Manufacturing Company at Milwaukee for several years, will be in charge of the Los Angeles office.

NEWS NOTES

INCORPORATIONS.

RUPERT, IDAHO.—The Star Electric Light & Power Company has been formed here and will engage in a general electric business. J. P. Pucket is manager of the new company.

FINANCIAL.

SEATTLE, WASH.—A $7,000,000 bond issue is announced by the Puget Sound Traction, Light & Power Company. The entire issue has been bought by a syndicate headed by Lee, Higginson & Company, one of the big Eastern bond houses, the negotiations having been consummated through the Boston office of Stone & Webster. The bonds bear 6 per cent interest, and run for five years, being redeemable February 1, 1919. The proceeds are to be used in retiring short-time notes due February 1 next, and for improvements and extensions to be made in and near Seattle during 1914. Within the past sixty days the company has also made an additional issue of its preferred stock to the extent of approximately $2,500,000, a part being subscribed by stockholders at par and the balance being taken by an Eastern banking syndicate. The preferred stock pays dividends at the rate of 6 per cent and the common at the rate of 4 per cent. Net earnings are sufficient to take care of all dividend requirements, interest on all other outstanding obligations, and still leave an amount over twice the interest charges on the new $7,000,000 bond issue.

ILLUMINATION.

BEAUMONT, CAL.—The Beaumont Gas & Power Company has applied for an electrical franchise to cover the greater portion of this city.

LOS ANGELES, CAL.—A landslide caused by the recent heavy rains, carried away about 500 ft. of Midway Gas Company's pipe line near Balboa, completely cutting off Los Angeles' supply of natural gas.

TEMPE, ARIZ.—The city council has been petitioned for the installation of an electric light plant at the same time as a special election is being held for the voting on the proposition of issuing sewer bonds.

HURRICANE, UTAH.—A special election was held January 27th for the purpose of voting on a proposal to bond the town in the sum of $5,000 for the installation of an electric light plant. The proposal carried.

SANTA BARBARA, CAL.—Proposed extensions of the electric system into both Carpinteria and Goleta districts are under consideration by the board of directors of the Santa Barbara Gas & Electric Company.

CORVALLIS, ORE.—That it will cost $111,570 to install a power plant and system adequate for Corvallis is the conclusion of the Commercial Club committee, composed of H. M. Parks, W. A. Hillebrand and A. H. Swartley.

HELENA, MONT.—The city council has designated March 28th for the special election when the taxpayers will vote on the question of granting a franchise for an electric light and power plant to the Standard Engineering Company, of which A. L. Goldschmidt is secretary.

BANNING, CAL.—Plans for a supply of electricity from the Southern Sierra Power Company at Banning are now under way, and work of stringing lines will be started immediately. The estimated cost is $281,655 and the plans include a substation and distributing system at Coachella.

PROVO, UTAH.—The city commission is considering a plan for improving the street lighting on the principal streets, as submitted by A. P. Merrill, local manager of the Utah Power & Light Company. It proposes to use fifty arc lamps, displacing the present incandescent street lighting system. The annual cost of the proposed system is $2800.

LOS ANGELES, CAL.—The board of public utilities has fixed the natural gas rate at 52 cents per 1000 cu. ft.; artificial gas rate at 70 cents, and for a mixture of natural and artificial gas at 61 cents. The action of the board was unanimous, and now awaits the approval of the city council, to become immediately effective until July 1st, the annual rate making date as provided by law. The board has ruled that the mixture of natural and artificial gas shall be on an even half and half basis.

LOGAN, UTAH.—The Utah Power & Light Company is conducting here an extensive demonstration of the numerous possible applications of electricity on the farm at the Farmers' Round-up in progress at the Agricultural College during this and next week. The features of the exhibit attracting the most attention are the electric ranges, which appeal particularly to the farmer's wife, and the irrigation pumping exhibit, which demonstrates so clearly the simplicity and economy of this method of irrigation.

LEBANON, ORE.—The petition of Scroggins Washburn asking for a vote to decide the question of a 20 year franchise to construct an electric light and water plant within the city limits has been disposed of. The council is unanimously in favor of municipal ownership of the light and water plant. The Lebanon Light & Water Company made a proposition to the city to buy its plant. They propose to sell the plant for actual value according to holdings shown on the books. Besides the machinery, building and pumping plant the company has a half interest in the canal, and it may be bought by bonds at 6 per cent. It is possible that the question may be put before the voters at a special election.

TRANSMISSION.

QUINCY, CAL.—Application has been made to the supervisors for right to erect and operate lines for transmitting electricity along roads in Plumas county by R. B. Young of Loyalton, Cal. Sealed bids for the franchise will be received until March 12.

KALAMA, WASH.—The wooden frame power house on stone and cement base owned by the Washington-Oregon corporation was destroyed by fire with a loss of $45,000. The three generators and all electrical equipment are worthless. The plant will be rebuilt on a larger scale.

LOS ANGELES, CAL.—A contract for leasing of power distributing systems of three local power corporations by the city for five years with option to purchase, has been submitted to the corporations. Upon their acceptance or rejection of contract depends whether the city will come to agreement on resume the fight for municipal distribution along old lines.

VICTORIA, B. C.—A new company just incorporated is the Stamp Falls Power Company, with a capital of $150,000. Its objects are important to the development of the center of Vancouver Island. Among which are to acquire the rights of the Ritchie Agnew Power Company in the Alberni District, and an option to purchase all the interests of the British Columbia Hydraulic Power Company and water rights on Nanaimo River, and the company's 40 year franchise for electric lights, power and heat in Nanaimo.

PORTLAND, ORE.—A system of switching so that their load dispatcher in the Electric Building can disconnect the trolley wires and their feeders, which are overhead in the "fire limits" of Portland, when a fire breaks out in any portion of the "fire limits," has been devised by the Portland Railway, Light & Power Company. This system is kept under constant test in order that each section may be intact and not interfered with by unauthorized parties. A complete map of the

system is in the hands of the fire department. Also a "Tapper Bell" has been installed in the Load Dispatchers' office so that he gets all fire alarms.

SAN FRANCISCO, CAL.—Referring to the value of the recent heavy rains, John A. Britton, president of the Pacific Gas & Electric Company, says: "These rains mean a guarantee in hydroelectric operation of no low water such as we have had for the last three years. That also carries the guarantee of absolute service for the coming year. All our reservoirs are now full, and, in fact, could have been filled twice over. This includes Lake Spaulding, where the dam has been completed to the 225-foot level, impounding 45,600 acre ft. of water. The total amount of water in all the reservoirs of the company is now 40,000,000,000 gallons. But the great value of the rains is that the ground is now so saturated that the runoff will continue longer, and consequently the storage will not have to be drawn on till much later than usual."

SEATTLE, WASH.—The Secretary of Agriculture has issued a waterpower permit to the Washington Railway & Electric Company of Tacoma, authorizing it to occupy and use lands within the Snoqualmie national forest under the act of February 15, 1901, for the purpose of generating hydroelectric power. Isaac W. Anderson of Tacoma is president of the company. The project covered by the permit involves the erection of nine dams, water conduits and power houses. One of these dams is for the combined purpose of storage and diversion while all the others are for diversion purposes only. The total area which will be flooded by the nine reservoirs is approximately 2164 acres. The project is located on Sultan River in Snohomish county. A transmission line approximately 55 miles long, will be required to transmit the energy to Everett, which is the nearest possible market of importance. The total power capacity of the combined project as rated by the engineers of the service is 32,000 h.p.

TRANSPORTATION.

LOS ANGELES, CAL.—The Pacific Electric Company has applied for a franchise for double track to connect its line at Sixth street and Ceros avenue with the south end of the proposed new Arcade depot.

NEWPORT, ORE.—The city council has granted a franchise to the Portland, West Coast Railway & Navigation Company, allowing the company the use of the streets and giving it a lease on 500 feet of water front on the bay.

POMONA, CAL.—The Pacific Electric Railway's line at Upland, a new line running from Upland to Alta Loma, will have to be practically rebuilt according to report that flood waters washed debris, etc., over the tracks and carried a large portion of the track away.

PARKER, ARIZ.—A franchise has been granted to W. H. Tharpe and associates for proposed electric railway system for Parker and vicinity, and application will be made at once to the interior department for right of way through the reservation. Actual work is expected to begin within 60 days.

OGDEN, UTAH.—P. D. Kline, general manager of the Ogden Rapid Transit Company, states that construction work will be started as soon as weather permits on the extension of their line to Logan, and later to Preston, Idaho. Specifications are now being prepared for the material and equipment necessary for the construction of this line.

SALT LAKE CITY, UTAH.—The residents of Ninth East Street South of the city limits have petitioned the Utah Light & Railway Company to extend their street car line along this street as far as Fourteenth South. General Manager Joseph S. Wells reports that the matter will be investigated, and if sufficient business is in sight to warrant the extension, it will be made in the near future.

OAKLAND, CAL.—The San Francisco-Oakland Terminal Railways, under the new management following the reorganization, will soon place orders for from 50 to 100 new cars of the p-a-y-e type, to take the places of the worn ones and possibly to increase the service on congested lines. According to General Manager A. W. McLimona, the steps on the new cars will be lower than those now in use.

SAN FRANCISCO, CAL.—The board of works has assured merchants that their convenience will be considered in constructing the Municipal Railway on Stockton street. Representatives of stores on Stockton street from Market to Post, who appeared before the board last week, were informed that the work on their blocks could be done at any time from May to December, and that they could say which month would suit them best. At the same time the board intends to widen the roadway and reduce the width of the sidewalks.

SEATTLE, WASH.—Every obstacle in the way of the city of Seattle acquiring the nine miles of the Seattle, Renton & Southern Street Railway property within the city limits and its equipment by condemnation proceedings, was swept aside last week by the supreme court of the state of Washington, when it upheld against every objection the right of the city to condemn, but reverses the judgment of condemnation without dismissing the action, because the receivers of the company were not made parties to the case. The supreme court suggests in its decision that the city obtain from Judge A. W. Frater, who appointed Scott Calhoun and Joseph Parkin receivers of the property, permission to include them as parties to the suit, and then proceed with the condemnation of the street railway property. This decision is by far the most important handed down in connection with the municipal street car controversy. The city will at once apply to Judge A. W. Frater for permission to sue the receivers, Scott Calhoun and Joseph Parkin, and have them made parties in the condemnation case. This will require not to exceed three weeks, upon the receipt of the formal decision from the supreme court, and soon after that the city will appear before Judge Gilliam and ask him to set date for the trial of the case.

TELEPHONE AND TELEGRAPH.

GRASS VALLEY, CAL.—The Mariposa Rural Telephone Company has been granted a permit to construct a telephone line along roads of Nevada County.

BUTTE, MONT.—A receiver for the Montana Independent Telephone Company is sought in a petition in intervention filed in the district court in the suit of P. B. Moss of Billings against the Interstate Consolidated Company. The petition is brought by holders of $17,000 worth of bonds in the Montana Independent Company. They allege that John MacGinnis has agreed to deliver the Interstate Company over to the Bell interests. A copy of the alleged agreement appears in the petition, together with a schedule of the prices at which he agreed to deliver the securities of the independent concerns over to the Bell interests. An injunction is also asked to prevent this delivery.

OAKLAND, CAL.—The suit of the city of Oakland against the Home Telephone Company for the recovery of $100,000 forfeited by the terms of its franchise at the time of its merger with the Pacific Telephone & Telegraph Company, may be dropped as the result of a pending compromise, by which the city will receive 2 per cent annually on the gross income of the Pacific company's systems until 1956, which will amount to some $2,000,000. A proposal for settlement of the suit was made to the Oakland City Council by the telephone company some weeks ago on the following basis: The suit against the company to be withdrawn; the telephone company to be permitted to operate under the provisions of the former Home Telephone Company; the Pacific company to pay to the city 2 per cent on its gross income in Oakland during the life of the Home company's franchise. After several conferences between the telephone officials and Mayor Mott, the city attorney and members of the city council, the advisability of accepting the compromise was referred for consideration to the Tax Association of Alameda County, which found that the terms of the agreement were advantageous to the city. The Home Company was granted a 50-year franchise in 1906.

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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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A NEW ELECTRIC SMELTING FURNACE.

FINANCING IRRIGATION AND POWER DEVELOPMENT.
BY JNO. H. LEWIS.

SAFETY REGULATIONS FOR ELECTRIC POWER COMPANIES.
BY W. K. FREUDENBERGER.

MITIGATION OF ELECTROLYSIS.

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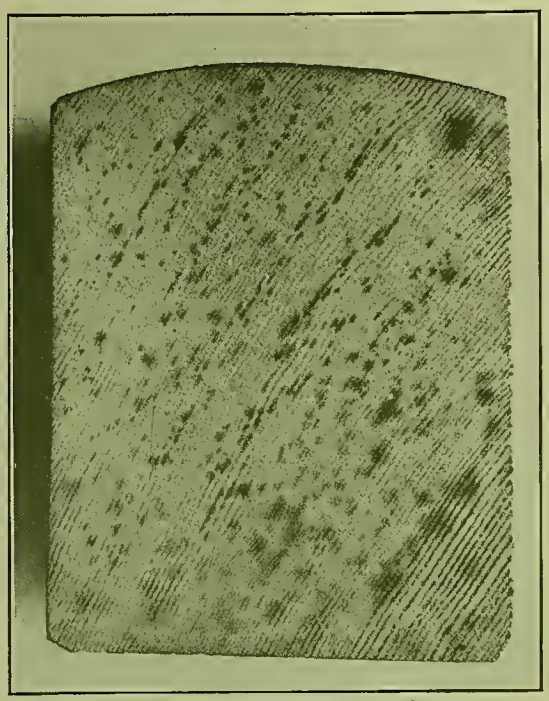
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VOLUME XXXII SAN FRANCISCO, FEBRUARY 14, 1914 NUMBER 7

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FINANCING IRRIGATION AND POWER DEVELOPMENT

BY JOHN H. LEWIS.

(This brief, though comprehensive summary of irrigation and hydroelectric power possible and developed in the Pacific Northwest, was presented by Mr. Lewis, who is State Engineer for Oregon, at the Regional Bank Hearing held recently at Portland, Oregon.—The Editors.)

We have in the Columbia River basin and tributary to Portland, 2,450,000 acres of land which have been irrigated at a cost of $70,000,000 or approximately $30 per acre. This cost will be increased to $120,000,000 when all of the projects are completed which will have been invested in irrigation projects during this decade. Portland is the logical industrial and financial center for this rapidly developing territory.

The highest dam in the world is now being constructed by the United States on the Payette-Boise



Water Power Favors Industrial Development of the Pacific Northwest.

were under way at the time the U. S. Census was taken.

Between 1900 and 1910, the irrigated acreage in Oregon, Washington and Idaho shows an increase of 120 per cent and the cost of contracted works increased over 700 per cent. If this rate of increase continues the next census will show that $500,000,000

project in the upper Snake River valley. The project now has a population of 75,000 people. It will ultimately cost $15,000,000 and irrigate 348,000 acres. Plans for the construction of a number of large projects have been worked out for Idaho, Washington and Oregon, and construction will proceeded as soon as some plan for financing is matured. One of the

largest is the Bruneau Project in Idaho, involving the reclamation of 636,000 acres at an estimated cost of $25,000,000.

Irrigation in Oregon.

In Oregon we have 686,000 acres of irrigated land and a water supply available for the reclamation of 4,000,000 acres in all. One-half of this area is in large projects which have been the subject of engineering investigations and which can be irrigated at a cost of $40 to $60 per acre.

Plans for a definite state-wide irrigation program are well under way. At the last session of the legislature $450,000 was appropriated for the completion of the 23,000 acre Tumalo Project in the Deschutes River Valley. Work is now under way. The Secretary of the Interior has agreed to contribute an equal amount for construction work in this basin.

At the same time $50,000 was appropriated for the preparation of plans and estimates of cost for the construction of various large projects throughout the state. This work is being carried on in co-operation with the Secretary of the Interior, who has contributed an equal amount. Already the field work on a 200,000 acre project in the Deschutes valley has been completed and this summer the John Day-Umatilla project of about 100,000 acres will be examined as well as smaller projects in Malheur, Harney, Klamath and Lake counties. These projects must eventually be constructed if our state is to attain its proper growth.

State Engineer's Records.

An index of irrigation development may be had from the State Engineer's records. The estimated cost of works to be constructed under water permits issued since February, 1909, is $51,000,000. The total for 1913 was $7,000,000, or $3,000,000 less than the average for previous years. This decrease indicates that fewer large projects have been undertaken, but otherwise shows a healthy development as a larger number of permits were issued during 1913 than the average for previous years.

Waterpower.

Twenty million horsepower or approximately one-third of all the undeveloped waterpower in the United States is located in the Columbia River basin. Of this amount, over 3,000,000 horsepower is found in streams within easy transmission distance of the city of Portland.

We thus have more undeveloped waterpower in the Columbia River basin, tributary to Portland, than the total which is now generated by various means and used in manufacturing industries throughout the United States, according to the recent census. Only 516,000 h.p. is utilized in the various industries in Oregon, Washington and Idaho.

The development and use of this resource will mean much to the navigation, irrigation and industrial development of the great inland empire.

It is only the past few years that any possible market for this power could be seen. With the invention and the phenomenal development of the electric furnace, a new era in the industrial development of the west is rapidly dawning.

It can be demonstrated that with cheap electric power, iron and steel can be produced in the vicinity of Portland at a cost comparing favorably with Pittsburgh; that iron ore can be had from China cheaper than it can be secured in Chicago; that the capital cost of an electric iron and steel plant is about one-third that for the ordinary fuel plant; also that electric steel is superior for railway rails, steel castings and tool steel.

With the development of this power and the resulting canalization of our rivers, the extensive iron, copper, lime, timber and other resources of the interior basin can be brought to Portland where lumber and other facilities may be found superior for the manufacture and marketing of such raw products.

The Columbia River basin is destined to compete successfully with the natural nitrate fertilizer industry of Chile, as enough nitrogen is found in the air, over one square mile of the earth's surface to supply the world for 50 years. To produce from the air, the nitrate fertilizer now used by the civilized world will require the investment of $860,000,000 in waterpower plants.

In addition there are many other electric furnace and electro-chemical industries where the cost of power is one of the leading items in the cost of production. Portland is destined to secure many of such industries which are seeking world markets. It will in time be known as the smokeless manufacturing city of the west.

That the people are alive to the importance of these facts is evidenced by the appropriation of $15,000 by the last legislature for the investigation of a 300,000 h.p. project in the Columbia River near The Dalles. The Secretary of the Interior has contributed an equal amount and joint work is now under way. A preliminary report indicates that power can be furnished in the vicinity of such plant for about $7 per horsepower year in comparison with $50 to $450 the usual commercial rates for varying quantities.

The object of this joint investigation is to secure definite information as to the cost of developing and transmitting this power to various points in Oregon and Washington as a basis for the adoption of some comprehensive waterpower policy which will lead to the rapid development of this resource, in the public interest. A constitutional amendment authorizing the issuance of state bonds for the construction of waterpower plants will be voted upon by the people of Oregon in November of this year.

The experimental stage of the electric furnace being over at this time, when the Panama Canal is opening the way for world commerce, it is clear that the industrial development of the Northwest will be rapid. To conduct our present business, which compares most favorably with other points in the territory, and to facilitate this rapid development which is sure to come, convenient banking and credit facilities are essential. Portland, located at the crossroads for north and south traffic, and at the point where many of the products of the great inland empire must be transferred to ocean carriers for world markets, is the logical banking centre for this territory.

EFFECT OF FORESTS ON RUNOFF.

BY J. C. STEVENS.

(Continued.)

Analyses of the Tennessee records such as that referred to, have been made by Prof. Willis L. Moore, Chief of the U. S. Weather Bureau, and M. O. Leighton, of the U. S. Geological Survey. Each arrives at radically different conclusions by using the records since 1883. Evidently this is too short a period from which to drawn conclusions. I shall later present some data of this kind in connection with the records of the Merrimac River.

Ohio River Basin.

The records of precipitation on this watershed begin in 1830, and the records of gauge readings at Cincinnati begin in 1858. The discharge data has been compiled by the United States Army Engineers and by the United States Geological Survey. Gauge records are found in publications of the army engineers and those of the Weather Bureau.

The extent of deforestation is unknown, but has been considerable. This river has also been held up by forestry advocates as an example of the injurious effects of deforestation. For that reason the records are of double interest.

The following table presents the data in similar fashion as for the Tennessee River, except that the total interval of 78 years for precipitation data is divided into eight periods, and the 50 years of precipitation and runoff records into five periods.

Ohio River at Cincinnati, Ohio.
(Drainage Area, 73,900 Square Miles.)

Period.	Precipitation. (inches)	Runoff. (inches)	Runoff per in. of precipitation. (inches)	Maximum discharge. (sec. ft.)	Minimum discharge. (sec. ft.)	Uniformity. Ratio
1st 8 years—1830-1837..	39.2					
2d 10 years—1838-1847..	40.0					
3d 10 years—1848-1857..	41.8					
4th 10 years—1858-1867..	43.8	17.0	.39	419,000	10,150	.024
5th 10 years—1868-1877..	40.3	15.8	.39	407,100	10.720	.026
6th 10 years—1878-1887..	41.7	19.0	.45	476.400	8,900	.019
7th 10 years—1888-1897..	41.3	17.0	.41	405,500	10,510	.026
8th 10 years—1898-1907..	39.7	16.7	.42	462,900	11,000	.024

Fig. 2 shows the hydrographs and the period averages in a manner similar to those for Tennessee River. The runoff per inch of precipitation has apparently increased coincident with a reduction in forest cover, which is directly opposed to the forestry theory, since this region is classed as humid. Now if this was also accompanied by a decrease in the uniformity of flow, our forestry friends might even yet find comfort in the records. But such is not the case. The lowest uniformity coincides with the period of greatest runoff, in the sixth period. An examination of the hydrograph will show high precipitation and high floods in 1882-3-4. Now if this is due to removal of forests, why were not the years 1890-1 also noted for high floods? Surely there was less forest area in 1890 than in 1882. The reason lies in the intensity and nature of precipitation, and not in the slightest degree in forestry influences. The general parallelism of the precipitation and runoff curves indicate that the former is the first, last and only cause of the latter. The amount of the one in the main govern the amount of the other, while variations in the nature and intensity of the one are reflected in variations in the runoff per inch of precipitation. The vegetation on the ground surface has too small an influence to be detected.

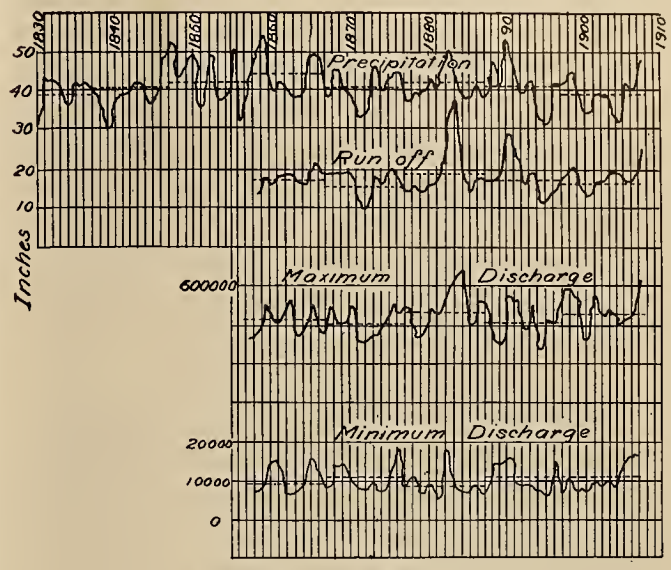


Fig. 2. Ohio River Chart.

Ottawa River Basin, Canada.

In connection with the proposed Georgian Bay Ship Canal, the Department of Public Works, Canada, has compiled the discharge of Ottawa River above Besserer's Grove (nine miles below Ottawa) from 1850 to date, and the precipitation on the watershed from 1866 to date. (Georgian Bay Ship Canal Report for 1908, Plates 30 and 56; also Progress Report 1909-1910, p. 41.)

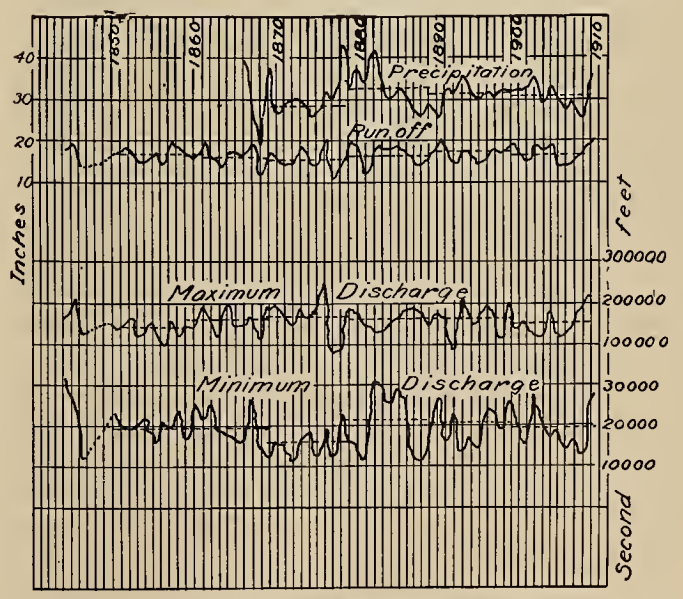


Fig. 3. Ottawa River Chart.

No detailed estimate of the amount of deforestation that has taken place on this watershed has as yet been made, except that it is known to be considerable. At one time the entire watershed was heavily forested with spruce, pine, etc. Lumbering

operations have been carried on extensively for the past 30 years at an increasing rate. The river valleys in the lower reaches have for the most part been cleared for agricultural purposes, yet the percentage of reduction of forests on this watershed is not great, but may be taken at about 10 per cent during the period of record.

The total drainage area above the gauge is 45,500 square miles. There are numerous lakes on the watershed, some of them being of large extent. A large part of the precipitation is in the form of snow, and the spring thaws cause annual rises of varying magnitude. They nearly always reach a maximum in May.

The treatment is similar to that followed for Tennessee and Ohio Rivers.

Ottawa River at Besserer's Grove.
Drainage Area, 45,500 Square Miles.

Period.	Precipitation. (inches)	Runoff. (inches)	Runoff per in. of precipitation. (inches)	Maximum discharge. (sec. ft.)	Minimum discharge. (sec. ft.)	Uniformity. Ratio
1st 10 years—1850-1859..		16.72		144,300	19,900	.138
2d 10 years—1860-1869..		16.38		161,000	19,700	.122
3d 10 years—1870-1879..	28.58	15.80	.55	168,000	16,100	.096
4th 10 years—1880-1889..	32.71	16.50	.50	165,800	21,200	.128
5th 10 years—1890-1899..	31.71	17.12	.54	166,700	20,500	.123
6th 10 years—1900-1909..	31.13	16.78	.54	153,000	19,200	.125

In Fig. 3 are shown the corresponding hydrographs.

The high uniformity of flow in this stream, compared with those heretofore considered, is accounted for by the large percentage of lake surface on its area. These are the true equalizers of the flow, and not the forests. The lowest uniformity is coincident with a period of highest precipitation, viz: 1878 to 1882, and certainly this was before any material reduction in forest cover had occurred. The fourth period, however, shows the highest uniformity (except the first) and this must not be given too much weight because of the inaccuracies of the earlier records. The whole record shows no change either in total runoff or in uniformity of flow that can in any degree be attributed to the removal of forests. In fact, the reduction of forest cover on this stream is comparatively slight. The headwaters are still covered with virgin forests.

Murray River Basin, Victoria, Australia.

On this watershed progressive deforestation has taken place during the past 25 years. Climatically, the country is semi arid. The waters of the stream are extensively used for irrigation, by both gravity and pumping systems. On this account it will not be admissible to use minimum discharge, nor the total annual yield, since this quantity is more or less under artificial control. The flood discharges however, can be safely used in a study of this nature. The official records, compiled under the direction of Stuard Murray, M. Inst. C. E. Chief Engineer of the Rivers and Water Supply Commission of the State of Victoria, have been used.

The practice of rink-barking (to kill) the trees on large areas in this region has been in force for many years. Some American Engineers (Engineering News, October 1, 1908. Proceedings of Annual Convention New England Water Works Association) personally familiar with the practice, state that it is extremely common in Australia and has been done to increase the stream flow. Dr. Elwood Mead, the present Chief Engineer of the Water Supply Commission, in a letter to me (Feb. 11, 1911), states that the real reason is to "improve the pasturage." The live trees shade the ground and draw sustenance from it and thus reduce the growth of grass.

It is impossible to ascertain in detail the amount of deforestation during the period of record, but it is known to be quite extensive.

Murray River at Mildura, Victoria.

Period.	Mean annual Discharge, (sec. ft.)	Average Maximum Discharge, (sec. ft.)
1st 20 years—1865-1885	11,800	28,900
2d 20 years—1886-1905	11,150	26,500
Change in 2d period..	6 per cent decrease.	9 per cent decrease.

The decrease in mean discharge had undoubtedly been due both to decreased preciptation and to diversions above the gauge. The records of precipitation do not begin until 1883, and this is too short a period from which to draw conclusions. The significant truth in the above table is that the flood heights have decreased during the period of record coincident with the removal of forests, instead of increasing as the forestry theory teaches. This, however, cannot be attributed to the removal of forests, but is due to variations in the amount and intensity of rainfall during the two periods and doubtless to regulation resulting from the construction of storage reservoirs in the watershed for irrigation purposes.

Merrimac River Basin.

Lieut. Col, Edw. Burr, U. S. Army Engineers, has made an exhaustive report on "an investigation of the influence of forests on the runoff in the Merrimac Basin," (House Document No. 9, 62d Congress, 1st Session, "Merrimac River, Mass., Between Haverhill and Lowell") from which the descriptions and data are taken. The latter have been arranged to conform to the manner of representation adopted for this report. We have the analysis of precipitation and of total yield and uniformity, and in addition are able to present data on the variations of moderate freshets or medium floods.

The Basin of Merrimac River lies both in New Hampshire and in Massachusetts. The headwaters are in the rugged White mountain region, and the middle and lower valleys are rolling country with some areas of lake surface and small swamps.

The underlying rock is gneiss and granite. Over these lie glacial drift of sand, gravel and boulders, frequently mixed with finer materials, and covered in the valleys with alluvium clays and other soils brought down from higher elevations. A large portion of the valley lands are, or have been agricultural, while the uplands are unfit for any growth except forests on account of the great masses of boulders and other glacial debris that cover the surface.

Originally the entire area was in forest. When the Pilgrims arrived in New England "they were much comforted, especially seeing so goodly a land and

wooded to the brink of the sea." As population increased deforestation of the land steadily progressed to secure agricultural land and to supply commercial lumber. After a time, owing to western competition, a decline in both lumbering and agriculture set in and large areas that were once tilled are now grown up to brush and timber, some of the timber being already of commercial size. These facts are well known, but the author of the above mentioned report had instituted a very careful study of the statistical data, and expresses his conclusions thus:

Deforestation (of Merrimac River Basin) continued progressively from the earliest settlements to about 1860-1870; reforestation through natural processes has progressed since 1870 at a rate which has increased from 1880 to 1900 or later; and the forest areas are larger now than in 1860-1870 by as much as 25 to 30 per cent of the entire basin.[4]

In New Hampshire, which is practically representative of the Merrimac Basin, the forest area has changed as follows:

Forest Area in New Hampshire.[4]

	Percentage of State	Percentage change.
1850	45.1	.....
1860	43.1	2.0 decrease
1870	43.1	0.6 increase
1880	46.0	2.3 increase
1890	59.1	13.1 increase
1900	67.4	8.3 increase

The discharge and runoff data have been compiled from gauge records kept by the Essex Company below its dam at Lawrence, Mass, since 1849. Discharges computed over the dam and through the wheels and mill-races of the company and by actual discharge measurements since 1888, serve to translate these gauge heights into mean daily discharges, from which the runoff has been computed.

The precipitation data are taken from reports of the U. S. Water Bureau and from records kept by the power companies along Merrimac River.

The following table gives similar data to those presented for the other basins discussed.

Merrimac River at Lawrence, Mass.
(Drainage Area, 4660 Square Miles.)

Period.	Precipitation. (inches)	Runoff. (inches)	Runoff per in. of precipitation. (inches)	Maximum discharge. (inches)	Minimum discharge. (inches)	Uniformity. Ratio
1st 9 years— 1850-1858.	.....	24.60	.....	47,800	2,160	.045
2d 10 years— 1859-1868.	41.20	23.21	.563	42,900	2,430	.057
3d 10 years— 1869-1878.	40.88	22.94	.562	46,400	2,500	.054
4th 10 years— 1879-1888.	40.91	21.70	.530	34,100	2,340	.069
5th 10 years— 1889-1898.	41.99	22.15	.528	40,600	2,270	.056
6th 10 years— 1899-1908.	40.04	21.90	.547	43,100	2,190	.051

In Fig. 4 are shown the hydrographs for this stream.

Again the direct relation between precipitation and runoff is apparent from the general parallelism of these two curves. The total runoff per inch of precipitation shows a slight decreasing tendency coincident with an increase in forest cover. This is opposed to the forestry theory and substantiates the belief that forests use large quantities of water, and hence always reduce the runoff. However, it is much more reasonable to believe that these changes are due to variations in precipitation and have occurred entirely independent of the forests. The uniformity ratio is seen to be highest when the forest area was least, in the fourth period, but the hydrographs show this to be a period of low rainfall, which readily accounts for it. The uniformity of flow on this stream has not sensibly changed during the period of record. The slight variations must be attributed to the precipitation and not to forests.

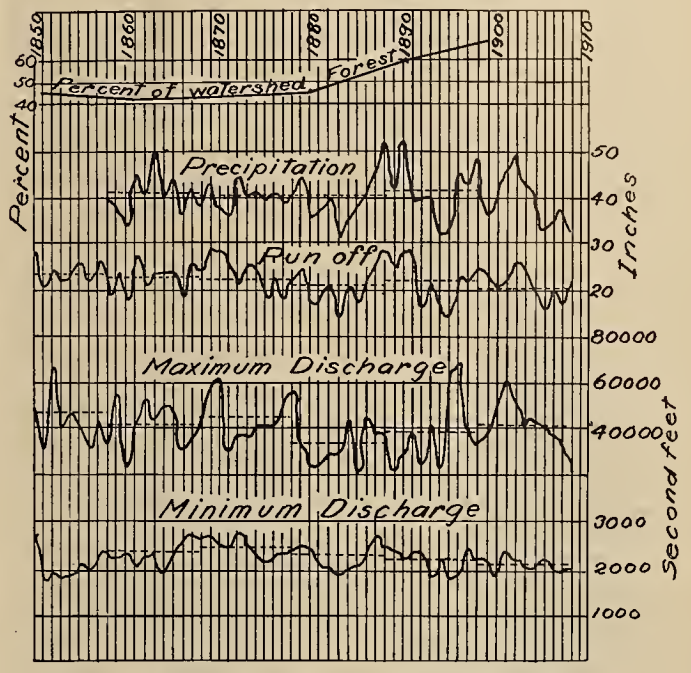


Fig. 4.—Merrimac River (at Lawrence, Mass), Chart.

(To be continued.)

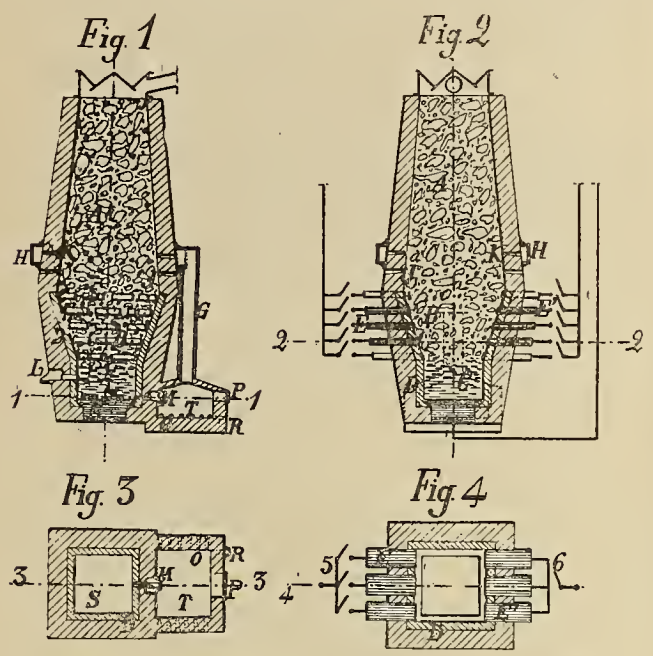
The resistance of the soil varies greatly with temperature within the ordinary range encountered in practice. Even at about freezing temperatures the resistance will be several times that at summer temperatures. This not only has an important bearing upon the magnitude of the electrolysis trouble that may occur at different seasons, but also indicates that where practicable voltage surveys should not be made when extremely low temperatures prevail.

Interesting wireless telegraph statistics relating to the year ending December 31, 1912, have been given out by the Bureau of the Census. The figures presented show that while there was a net deficit in operation in 1907, a net income was the result of the business in 1912. The gross income increased $562,367, or 527 per cent, over 1907. A great part of this income was the rental of wireless apparatus for ship equipment. The expenses, including charges for depreciation in 1912 increased $504,091, or 314.4 per cent. The great decrease in assets—$22,581,700, or 68.5 per cent—is due to the disappearance of one large company in a merger of interests. The decrease was largely in the value placed on patent rights, good will, and contracts in 1907, and on treasury stock. The amount expended for construction and equipment increased $888,156, or 280 per cent over 1907, and the number of employes 782, or 444 per cent; the increase in salaries and wages being $311,835, or 381 per cent.

4 Ibid p. 15

A NEW ELECTRIC SMELTING FURNACE.

The availability of large deposits of iron, copper and lead ores in the West within reach of sources of cheap hydroelectric power make the electric smelting of these ores a necessity of the near future. Many furnaces have been designed and much money spent in overcoming the difficulties of the electric reduction of ores. One of the simplest and most practical is that recently patented by Louvrier and Louis, its main advantage being its temperature regulation by means of an electrode switch instead of movable electrodes. It can be used at high voltages and in all sizes up to



Sectional Details Louvrier and Louis Electric Furnace.

40,000 h.p., which the inventors claim is sufficient to produce 500 to 550 tons of pig iron daily.

The general arrangement of the furnace is indicated in the drawing, which represents a polyphase furnace.

Fig. 1 is a vertical section along 3-3 of Fig. 3. Fig. 2 is another vertical section along 4-4 of Fig. 4. Fig. 3 is a horizontal section along 1-1 of Fig. 1. Fig. 4 is a horizontal section along 2-2 of Fig. 2.

The furnace proper consists of three principal parts—the shaft A, wherein the progressive heating of the ore takes place; the bosh B, which is the zone of reduction, and the crucible C, where the molten metal accumulates. The crucible and the reduction chambers are lined with very refractory and non-conducting material D. The bottom S of the furnace is conducting and is connected with one of the phases of the current. It is made from varying material to suit each particular case; for instance, for iron ore reduction it is made of a piece of cast iron, with some cooling arrangement.

A series of openings are horizontally disposed at various heights in the two opposite walls of the bosh. Through each of these openings passes a well-fitting electrode. These electrodes form two symmetric series, opposite to each other. Each of the series corresponds to a phase of the current and each electrode in the series can be connected with its corresponding phase by means of a switch.

In smaller furnaces each electrode takes up the whole width of the furnace; in larger furnaces two or three electrodes are arranged at the same horizontal height side by side, as shown in Fig. 4, so that the size of each electrode remains within reasonable limits.

The electrodes of each series are insulated electrically from the other series by the furnace wall, which is non-conducting. The electrodes are pushed through the openings into the furnace so that they touch the charge without being immersed in it. The small space between the furnace wall and the electrode is luted in order to avoid leakage of the gas formed inside the furnace.

The electric current passes through the charge between the two series of lateral electrodes and between these and the bottom electrode. The charge acts as resistor, and as all parts of the charge are traversed by the electric current, a practically uniform temperature is obtained.

Evidently the current passing through the charge and consequently the temperature in the furnace depend on the number of lateral electrodes that are connected to the circuit and on the relative position which they occupy.

The temperature is always easily regulated by a simple movement of the electrode switches. The electrodes themselves are, therefore, immovable or nearly so; all that is necessary is to push them in from time to time in order to compensate for their consumption. As air cannot enter the furnace and as no hot gases circulate around the electrodes, this consumption is relatively small and the compensation need only take place once or twice in a week.

The crucible C is provided with two tap holes, one, L, for the slag and the other, M, for the metal.

For operation with single-phase or continuous current the furnace is arranged in the same way. One possible arrangement is a conducting sole connected to one pole, and a series of lateral electrodes occupying two opposing walls of the furnace and all being connected to the other pole of the circuit. Another possible arrangement uses two lateral opposite series of electrodes connected to the two opposite poles of the circuit, without a conducting sole.

In the reduction of 50 per cent iron ores, for each ton of pig produced, the energy consumption should not exceed ¼ h.p. year and the electrode expense 8 cents.

But slight modifications are necessary to adapt it to smelting copper, lead or zinc ores. A 40,000 h.p. furnace, it is estimated, would handle 2000 to 2500 tons of 5 per cent copper ore daily with a consumption of from 0.06 to 0.03 h.p. year, according to the routine of the ore and its sulphur content. Electrodes would cost about 2 cents per ton of ore treated. The total estimated cost, including general expense and amortization amounts to $1.20 per ton of ore treated when the smelter produces its own energy from water power. Further details are given by Francis Louvrier in the Dec., 1913, issue of Metallurgical and Chemical Engineering from which the facts in this abstract were prepared.

MITIGATION OF ELECTROLYSIS.

Damage to pipes and other buried structures by stray currents from the electric railway at Springfield, Ohio, has been carefully studied by the U. S. Bureau of Standards. An insulated negative feeder system applied to the tracks is recommended as the primary means of mitigation after a full consideration ot all systems available.

Surface insulation of pipes by paint, treated textiles or tarred paper, insulating joints in pipes, and pipe drainage systems by direct taps between pipes and rails or negative feeders to pipes were all exhaustively tested and found wanting.

Other proposed methods include (a) chemical protection, which contemplates surrounding the pipes with certain chemicals, such as lime, etc., which are known to have a tendency to inhibit corrosion under certain circumstances, (b) the use of cement coatings on the pipes, (c) cathodic protection, or protection of pipes by maintaining them negative to certain structures by means of battery, motor generator, etc., (d) favorable location of pipes with respect to rails, (e) the use of non-corrodable conducting coatings, and (f) what may be termed electric screens which are sheets of metal placed near to or surrounding a portion of the pipe and electrically connected thereto. It is not necessary to discuss these at length here, as such a discussion will be found in publications of the Bureau of Standards to be issued shortly and it need only be said that the investigations showed that none of these methods can be considered seriously in connection with the permanent mitigation of electrolysis.

A more logical and at the same time a more effective and economical procedure is to attack the source of the trouble by applying remedial measures to the railway system. A number of methods are available for this purpose, but the majority of these, viz, the "alternating current system," the "double trolley system," "three-wire system," "negative trolley," "periodic reversal of trolley polarity," and "uninsulated negative feeders to rails," considered solely as methods of electrolysis mitigation were either impracticable or else open to the objection that the expense and operating difficulties attending their application were rendered unnecessary, because of the fact that there are other adequate methods available for general application which are comparatively cheap to install and which introduce but slight complication into the operation of the system. These latter methods are the four types of insulated negative feeder systems; (a) boosters in separate feeders, (b) without boosters, (c) single booster system, (d) inverted booster system. It is possible by the proper application of any of these methods to reduce the potential gradients in the earth to almost any desired degree, and they can consequently be made very effective in relieving electrolysis troubles. In special cases, however, it may sometimes be better, where conditions are favorable, to combine one of these methods with either the insertion of a moderate number of insulating joints in pipes, or with the use of a very limited amount of pipe drainage, the insulated feeder system being applied to reduce potential gradients throughout the system to a very low value, and one or the other of the auxiliary systems used to practically eliminate any residual electrolysis that might still remain. An additional advantage that would result from the proposed installation grows out of the more uniform voltage available at the cars. The rail drop being reduced to a small fraction of its former value the variation of car voltage will be chiefly that due to the drop on the positive side, and hence the voltage regulation at the cars will be materially improved. This gives rise to much more satisfactory car lighting, a matter of considerable importance to the traveling public.

In Springfield the insulated feeder system without boosters offers the most economical effective solution of the problem. The plan has been worked out in detail in Technologic Paper No. 27, the size and location of each feeder being given, and the first cost of the installation and the economies resulting therefrom are carefully estimated. Conclusions drawn from these detailed calculations are that the economies resulting from this initial outlay make it, from the start, a dividend-paying investment, the saving being sufficient in itself to justify the investment quite apart from its effect in eliminating electrolysis troubles.

Statistics of ocean cable systems for the year 1912 have been given out by the Bureau of the Census. Statistics of merely holding companies and of Federal Governmental cables and the statistics of two foreign companies, the Deutsch Atlantische Telegraphengesellschaft and the Compagnie Francaise des Cables Telegraphiques, having cables landing in this country, are not included. The figures, as presented, show that during the semidecade 1907-1912, the number of operating companies remained the same. The increase in nautical miles of cable was 21,375 or 46.2 per cent. There was a slight decrease in number of cable messages reported, but the gain in amount of income received from telegraph traffic was $727,518, or 9.9 per cent. The net income, as reported, decreased $1,076,227, or 26.7 per cent, there having been an increase in cost of operation and maintenance amounting to $1,803,279, or 81.8 per cent. No charges for depreciation were reported in the expense account at either census. The increase in profit and loss surplus was $3,001,083, or 85.8 per cent. Reserves were increased very largely, but the total can not be shown separately, as it is practically that of one system. The amount of capital stock outstanding was $2,689,400, or 5.1 per cent, greater in 1912 than in 1907; the number of wage earners increased 449, or 37.2 per cent, and the salaries and wages, $251,931, or 27.5 per cent.

LETTER TO THE EDITOR.

January 27, 1914.

Referring to the article on Electric Stimulation of Plant Growth in your January 24 issue I find that my manuscript contained two errors. These errors came in the final writing and escaped my attention. In the data given with Fig. 3 the watts per cu. ft. should be 3 instead of .03 and the watt-hours per cu. ft. should be 100.8 instead of 10.08. This will be seen at once as the test shown in Fig. 3 falls almost exactly on the curve of Fig. 1 as to increase in size.

Very truly yours,

W. D. PEASLEE.

LIGHTING METHODS

METHOD IN HOME LIGHTING.

[Concluded.]

8. Kitchen, Pantry and Cellar.

If direct lighting is chosen for the kitchen it should be installed high up so that every corner of the room is properly lighted. The more efficient types of glassware may be used in this location, as illumination rather than appearance is the end sought. It is advisable to install a portable lamp at the range with a comparatively short extension (cord) and a wire guard. There are many such inexpensive portables on the market provided with a handle, and a hook for hanging by when not in use. The lamp should be all frosted. A bracket light should be provided over the drain board of the sink, care being taken to equip the lamp with glassware giving good diffusion.

Semi-indirect lighting in the kitchen offers a means for the use of a center ceiling outlet only, the portable and bracket lights being then not required.

The cost need not be prohibitive as an inexpensive adapter is on the market which permits the use of ordinary commercial types of reflectors inverted, for this purpose.

Taking into consideration the necessity for reducing shadows to a minimum so that they are not objectionable when cooking is being attended to or work done at the sink, heavy density "opal" reflectors, such as those made under the name of Pyro, or Pheno, are recommended for this purpose. These give a small direct component of light and hence fainter shadows. A higher intensity of general illumination must be provided than would be the case with the combined local and general illmination such as that suggested with the direct lighting system abovementioned.

The greater intensity in general illumination is suggested with semi-indirect lighting and the non-use of bracket lights recommended for the reason that these last are incongruous when this system of lighting is used. The object of semi-indirect lighting is to secure perfect diffusion of the light with an elimination also of glare. To install a bracket light is to defeat this purpose. Even should a very dense glassware be chosen, and inverted, it is always brilliant by contrast or throws a too brilliant light upon a part of the walls. These are usually, in a kitchen, light in color, and this emphasizes the annoying brightness just above the bracket fixture.

A wall plug with switch and pilot light should invariably be installed to provide for the use of an electric iron, now an indispensable time, labor, and worry-saving appliance which it should be possible to use readily in every home.

If the sink is in the pantry as is the case in some of the smaller homes, and the pantry is of sufficiently large size, a bracket light should be provided over the drain board of the sink and a ceiling fixture fitted with an opal diffusing globe. If the pantry is small, this last mentioned fixture will be sufficient. The first arrangement is recommended when direct lighting is used in the adjacent kitchen, the last is suitable for any system of kitchen lighting.

In the cellar or basement one or more lamps should be provided for the purpose of local illumination. Portables with wire guards, such as that described for the kitchen range, will be found indispensable.

One of the main causes for high lighting bills is the careless burning of lamps installed in places where they may be easily forgotten. The basement light is the chief offender. Left burning for a whole month, as is often the case when the family is away from home and this single light will run up an "unexplainable" bill of $2.50 or more.

It is advisable to insure against this possible loss by installing a switch with signal light in the hallway at the head of the basement stairs so that the basement light is thus shown to be burning if unintentionally left on.

Out of sight is then brought to mind.

9. Bedroom, Bathroom and Boudoir.

Colonial furniture in bedrooms is now quite commonly used but it is rarely the case that the lighting fixture is typical of the same period. This style is particularly mentioned as not only is the furniture pleasing and appropriate, but Colonial lighting fixtures with their upright unit are particularly suited to this service. As a matter of fact, a five or six arm electrolier with upright, totally frosted lamps of low wattage comes about as near perfect a lighting unit as could be desired. Practically any of the properly designed Colonial fixtures are effective and comparatively efficient.

Generally, bedroom lighting should be well diffused and clear lamps, even with pendant shades or reflectors are not permissible.

If direct lighting is decided upon the glassware should totally enclose the lamps. Latterly several beautiful and appropriate designs of this kind have been placed on the market. Wiring should be carefully laid out and the furniture arranged on the plan, for two dressing table bracket fixtures should be provided as well as a bracket lamp at the head of the bed.

Reading in bed has been rendered safe electrically and few wish to forego this indulgence.

Semi-indirect lighting with a small direct component of light, and indirect fixtures, are very satisfactory for bedroom lighting, but it is advisable even with indirect and semi-indirect installations, to provide an adjustable bracket lamp at the head of the bed, or a portable. In either case, an opaque reflector, also adjustable, should be used.

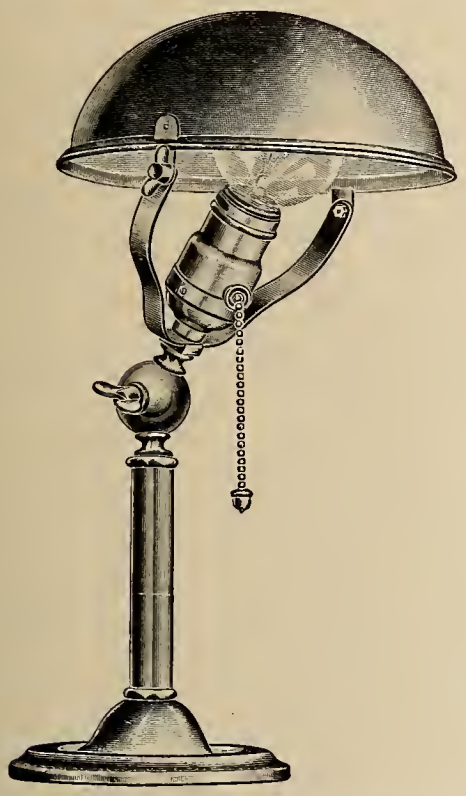
This will permit one to read in bed, or to light up temporarily during the night without annoyance to any other sleeper in the same room. Such a light is invaluable also for all night burning which is sometimes essential.

The switch for this lamp should be in an easily accessible place but on the wall, as to grope in the

dark to switch on a portable at the lamp is inconvenient to say the least, and oftentimes noisy.

The comfort of electrically lighting clothes closets cannot be calculated. This possibility is to most people perhaps better appreciated in anticipation, for all have experienced the inconvenience and difficulties encountered when endeavoring to locate things in closets not well lighted.

Whatever does away with the necessity for using matches for temporary lighting even if on rare occasions only, is a good investment.



Adjustable Portable With Opaque Diffuse Reflector.

The fear of lights left burning is easily overcome by the use of switches which automatically cut in the light when the door of the closet is opened and cut it out of use when the door is again closed.

Electric lights should be provided for all closets.

The boudoir lighting arrangements must of course be left to the lady of the house as to choice of fixtures and style of lighting, but the fundamental requirements are the same in this room as in the bedrooms. The special lighting provided depends entirely upon whether it is to be used as a work-room, a dressing room, or a happy combination of both.

In any event a baseboard receptacle conveniently placed will be found invaluable for the use of small electric appliances such as the luminous radiator, electric curling tongs and so on. A sewing machine lighting fixture might be connected to this outlet and will certainly be found a boon.

Bathroom lighting is best carried out by means of a semi-indirect lighting fixture as this room is not as a rule large and a comparatively small lamp will, with the light colored walls and ceiling, give a high intensity of illumination. The light is used for only a short space of time and economy of current consumption should not enter into consideration.

If direct lighting, which is here of necessity unsatisfactory, is nevertheless installed, bracket lights should be provided on either side the shaving mirror and these equipped with diffusing glassware.

10. Servant's Bedroom.

It often happens that this room has the disadvantage of being the last considered and as a consequence is usually equipped with a drop cord. The servant may in nearly every case be relied upon to purchase a long extension cord and this is not only unsightly and an inconvenience, but may prove dangerous and expensive.

If a drop cord is selected for this room it should be fitted with a pulley and counterweight and made of sufficient length to reach the different important points in the room such as the head of the bed, the bureau and so forth. At each of these points an inexpensive bracket should be provided to which the lighting unit may be quickly and securely attached.

On the other hand, a semi-indirect fixture composed of an opal reflector and an adapter, will prove inexpensive and most economical.

General Remarks.

In this article has been outlined the fundamental requirements of good lighting in the home. The different systems and the suggestions made, will be taken up in more detail in further articles.

The wiring plans and specifications are of great importance and will be considered in a special article which will cover not only the lighting installation but the wiring for all appliances which might be used. From such a complete specification may be abstracted the explanatory details to cover any particular installation.

But before this is done an article will be published on planning lighting installations. This will show the method of arriving at the size of lamp required and will give further aids for determining the system of lighting to be used.

Fixtures of all styles—direct, indirect, and semi-indirect have been but referred to in general. These will from time to time be dealt with in more detail, as also will the design of lighting glassware and its proper use.

This proper lighting of the home is of intense importance and will be dealt with from every possible angle. It should however be borne in mind that general directions while of great value fail in particular instances, especially where the decorative features have to be considered.

What is good for the goose is not always good for the gander. Equipment in one room beautiful and harmonious, will in another appear entirely out of place.

It is an excellent thing for the trade that habits and tastes differ. This urges improvements in design and application. The object of these articles is therefore not to show how the specialist in this line may be elminated, but rather to emphasize his importance to show how you may better appreciate his view-point and the necessity for close co-operation that a successful installation embodying the best method in home lighting may be assured.

SAFETY REGULATIONS FOR ELECTRIC POWER COMPANIES.

BY W. K. FREUDENBERGER.

(This paper was read by the author, who is Chief Engineer State Public Service Commission, Nevada, at the recent industrial safety conference held at Reno. Standard specifications are referred to and the requirements of the laws of Nevada governing safety regulations for electric power companies stated. The small number of accidents which have occurred in that State are also made a matter of record. The discussion of the paper is included.—The Editors.)

The above named subject was assigned to me for a paper to be presented at this meeting, with the explanation that it is for the purpose of securing uniform practice in the protection of high voltage electric lines, and, further, that it touch upon the Nevada laws on the subject.

Taking up the subject of uniform practice in the construction of electric lines, including all classes, from low voltage to extra high voltage, I unhesitatingly recommend the adoption of the specifications prepared by the National Electric Light Association, and published in their 1911 report.

In order to properly bring the subject before the meeting for discussion, some of the most important parts of those specifications are attached as an appendix.

Adverting to the Nevada laws on this subject, I find the following:

Laws of Nevada, Approved March 26, 1913.

All regular line wires for electric light or power service, shall be placed a distance of more than 16 in. from the center line of any pole, whether or not they are attached to same.

Line wires intended to carry more than 600 volts, shall be spaced 4 ft. or more in a vertical direction from line wires intended to carry less than 600 volts, but the distance between such wires may be only 32 in. in a horizontal direction if placed on the same crossarm.

Provided, however, that at all times a clearance of not less than 2 ft. in a vertical direction at point of crossing is maintained between wires carrying more than 600 volts, and wires carrying less than 600 volts.

All crossarms on which are lines carrying from 600 to 15,000 volts, shall be painted a bright yellow, or, on such crossarms shall be placed enameled iron signs, providing in white letters on a green background, the words "High Voltage," and these letters shall not be less than 3 in. in height, and said signs shall be securely fastened to the face and back of each crossarm.

All guy wires attached to poles carrying electric light or power wires, shall contain insulators at a distance of not less than 4 ft. nor more than 8 ft. (measured along the line of guy wire) from the upper end thereof, and not less than 8 ft. vertically above the ground from the lower end thereof, and provided further that whenever two or more guy wires are attached to same pole and same anchorage there shall be at least 1 ft. vertical space between the points of attachment. And further provided, that where guy is attached to a pole or structure of steel or other conducting material, which is thoroughly grounded, no insulation shall be required in any point in said guy.

All electric light and power wires which are run vertically on poles shall be wholly encased in conduit equal in durability and insulating efficiency to a wooden casing not less than 1½ in. thick.

Arc lamps and transformers shall not be placed on the same pole.

None of the provisions of the preceding sections shall be held to apply to direct current electric wires having the same polarity, except the spacing between pole and wires.

All span wires shall contain insulators at each end, insulators to be placed not less than 2 ft. nor more than 4 ft. from the ends.

The Public Service Commission of Nevada shall see that the provisions of this act are enforced.

Any violation of any of the provisions of this act shall be deemed a misdemeanor and shall be punishable upon conviction by a fine of not exceeding $500, or, by imprisonment in a county jail not exceeding six months, or by both such fine and imprisonment.

This act shall take effect six months from the date of its passage in so far as it relates to new work, and a period of five years shall be allowed in which to reconstruct all existing work and construction to comply with the provisions of this act.

The following law also applies to the larger electric companies operating in this state; those which have filed their acceptance of the terms of the provisions of the act approved March 2, 1901, Chapter 25, Laws of 1901, or which complied with the procedure authorized by Chapter 190 of the Laws of 1907. This law coming under Chapter 132, Laws of 1909.

Section 2. Such persons or corporations shall keep their plants, poles and wires, and necessary appurtenances in good repair, so as not to interfere with the passage of persons or vehicles or the safety of persons or property. Such poles shall be not less than 30 ft. in height, and the wires strung thereon shall be not less than 25 ft. above the ground, and such persons or corporations shall provide a competent electrician at the expense of such persons or corporations, to cut and repair such wires as are necessary for the removal of the buildings or other property through the streets of said counties, cities or towns with all due diligence.

Section 3. The appurtenances of said plant shall be of the most approved construction for the comfort and conveniences of the inhabitants of said counties, cities and towns of this state.

Although there have not been a large number of serious or fatal accidents on the high tension lines in this state, the number could be still further reduced by using greater care. I have gone over the accident reports made by the public utilities of this state for the last three years, which are on file with the Public Service Commission, and find that there were four accidents in 1911, three in 1912, and three in 1913, briefly described as follows:

Year 1911.

Lineman working on a corner pole guyed in only one direction. Pole broke off at ground line, resulting in a broken leg and sprained right arm.

Lineman repairing lightning arrester, exposed himself to the live side of same, and was severely burned.

Lineman was removing some unused wires from a pole. Pole had rotted off at ground line. When wires were removed the pole fell, resulting in a broken leg. Man was fastened to pole by a safety belt.

Lineman killed when telephone wire came in contact with high tension line. A line gang were stringing a pair of telephone wires on the poles of a live high tension line.

Year 1912.

Laborer was killed by touching an overhead high tension wire with an iron pipe. The wire was probably not more than 15 ft. from the the ground.

Three men in a surveying party using a 600 ft. steel tape, working beneath a high tension line, flipped the tape up against the wires and were all more or less severely burned.

Workman was killed by bringing a ladder into contact with a high tension line which was about twenty feet overhead.

Year 1913.

High wind blew down a pole carrying high tension line which came in contact with another line, resulting in a workman on the latter line having his hands severely burned.

Patrolman had his hands badly burned by a lightning stroke. He was standing on the ground repairing a dead transmission line wire, and had the line grounded with safety chains in the regulation manner.

Mining company built up a dump beneath a transmission line to such an extent that a workman in raising a track rail brought it in contact with the wires and received slight burns.

In addition to these reports I will refer to several fatal accidents which occurred in Nevada before 1911.

In 1904 a lineman was killed while repairing a dead line, which was on the same poles with a live line, the wire from which he received the fatal shock evidently having come in contact with the live wires. The manager of the company operating this line, states that since this accident no repair work has been done on this line until both circuits have been disconnected and grounded.

In a second case, occurring in 1909, a man was electrocuted by leaning against a corrugated iron building with one foot against a tram rail which extended into a tunnel. A 2000 volt wire, which crossed over this building came in contact with the roof. The sagging of the wire being caused by the breaking of a guy wire two poles distant from the building.

In a third case, a carpenter was killed when he turned a switch on a 110 volt circuit. It was suspected that the distributing line had come in contact with a 2000 volt line. Since that time all transformer neutrals on the system have been grounded.

A fourth case occurred in 1909. A lineman was electrocuted while tying in live wire lines carrying 4000 volts.

A fifth case occurred in 1909. A lineman was electrocuted by being grounded from a 4000 volt line to a guy wire which was not properly insulated. The line was supposed to be dead at the time, but due to an oversight of the entire repair gang one switch had not been opened.

A sixth case occurred the same year. A lineman was electrocuted when he climbed a tree and attempted to remove a loose limb from contact with a 2000 volt line.

A seventh case occurred in 1910. A lineman was electrocuted while working on a 220 volt line. A 2000 volt line became loose and dropped on a transformer, and in some manner the higher voltage was transferred to the line on which the man was working.

The Telluride Power Company, one of the pioneers in high tension transmission, writes as follows on this subject:

On the transmission lines where one would expect the greatest danger, we have had practically no serious accidents. We never work on a live high tension line, nor do we employ the construction now coming into such widespread use of having two 3-phase circuits on one structure. Before any repairs are made to any section of line, switches are opened at both ends. In addition, we have a rigid, switch-type, grounding and short circuiting device to prevent dynamic voltage being thrown on the line and to remove static charges. These grounding devices are arranged so as to lock shut and be under the absolute control of the men working on that particular section of line.

We do not install telephone wires on our high tension transmission structures. Our reasons are mainly to avoid operating difficulties rather than to obviate any danger there may be.

Our stations are so designed that operators cannot come in contact with any high tension parts in the ordinary pursuit of their duties. During the 15 years operation, several accidents have occurred, but they may all be attributed to occasional lapse of human vigilance in pursuit of a thorough knowledge of the danger. The operators are thoroughly cognizant of the danger when doing special work, and there seem to be no further measures toward the protection of human life than we have already taken.

In further reference to this subject I have for distribution a number of copies of the Safety Regulations for Public Utilities which were issued by the Public Service Commission. I also have single copies of safety rules issued by some of the large operating companies which anyone present may inspect.

In conclusion I will say that in my opinion the best way to secure safe construction and operation of high tension lines and apparatus is to employ none but competent and experienced men.

Discussion.

George A. Campbell, general manager of the Truckee River General Electric Company and the Reno Power, Light & Water Company opened the discussion. He dwelt principally on the work of safety inspectors sent out by the Stone & Webster interests and who had recently made very careful inspections of the plants in and near Reno. Although the management had expected a good report on the latest plant, a three-page report had been rendered by the inspector, recommending the installation of barriers and other safeguards. The other plants had been treated in the same way, an exhaustive report having been rendered on each. In addition, the inspector presented a report covering general accident dangers, in which were treated such matters as ladders, fences, railings, emery wheels, wiring parts, etc. Considerable space was given to housekeeping accident prevention and the necessity of using proper precautions with tools and implements. He said the operators had taken kindly to the safety first movement and he expected good results from it.

Fred A. Mechling, manager of the Nevada-California Power Company, spoke of the dangers of grounding motors in mine work. Their system comprises 350 miles of 50,000 volt and 50 miles of 6600 volt transmission line and, in addition, the lighting circuits. When a line is being worked on it is killed and grounded and as an extra precaution safety chains are placed. On all the 6600 volt lines linemen are required

to wear rubber gloves, insulated to 10,000 volts. All lighting transformers are grounded. As showing how the unexpected sometimes happens, he cited a recent case in which some boys had thrown a baling wire over the 6600 volt lines crossing with the arc circuit below. About a mile distant the arc and incandescent circuits had become crossed by a wire. As a result a customer in turning on a light in his basement received a severe shock and if he had not broken the lamp cord in endeavoring to release himself, the accident might have resulted in a fatality.

L. W. Crehore, electrical engineer, Fallon (Nev.), Municipal plant, continued the discussion and said in part:

Safety should be one of the first considerations of every power plant and distributing system. This applies in a more marked degree perhaps to those operated by municipalities than to others. Because disregarding the fundamental principal that no person or group of persons has a right to sacrifice human life or be responsible either directly or indirectly for damage to property or personal injury, and considering the subject from a purely commercial point of view, it is a fact that municipalities are in nearly all cases forced to pay larger sums to liquidate damage claims than are private corporations, resulting necessarily in high cost of service and in some instances increased taxation, to say nothing of censure brought upon public officials and through them upon the citizens themselves.

Early in 1912 the city of Fallon in this state, through its Mayor, George Sherman, and the city council, issued bonds to the amount of $15,000 for the purpose of constructing a municipal distributing system, entering into a contract with the U. S. R. S. for a power supply to be delivered at 2300 volts at a substation located near the city limits. The building of the system was commenced in the summer of the same year on force account and 5½ miles of line completed September 21, on which date service to customers commenced. During the construction of the system and later when operating, the mayor and council have acted in the nature of an advisory board, filling a position similar to that of a board of directors in a private corporation, and to them and their good judgment credit is due for making it possible to build the system in a substantial manner, with the best material obtainable, and labor at a fair wage, giving due consideration to safety at all times.

Mr. Crehore then gave a description of the methods of line construction and safety precautions adopted by the municipality.

F. O. Broile, superintendent Elko-Lamoille Power Company, contributed the following to the discussion: It is a well recognized fact that in most damage suits that are brought into courts, the injured party was injured, apparently by carelessness or neglect on his own part. When investigated it is generally found due to momentary forgetfulness. If the injured party had remembered at the particular moment that there was danger in a certain operation, he would not have done what he did. Call it what you will, when thoroughly examined, it is generally momentary forgetfulness. Some people are more careless than others; they take greater chances; they estimate that they can do things and carry them to a greater extreme than prudence would justify, and some day, the inevitable occurs. They do not, however, mean to get themselves injured; they think that there is no danger, or that they can escape the penalty of doing certain things. They have done these things several times before when everything was just right, but the unexpected occurs in some manner, the conditions are changed suddenly, and they cannot escape being injured or killed. This kind of danger, however, is probably less frequent than the other, that due to momentary forgetfulness. Employers think that, in any case, they ought not to be held financially responsible for the accident. I believe that a broader view of the matter should be taken, and we should realize that as long as human nature is what it is, we should make every endeavor to avoid injury, even going beyond the point legally demanded. Those who have had damage suits decided against them, should look upon the verdict, not as a charge of neglect or carelessness upon their part, but take the broader view, that it was an accident of the industry, and that the more humane method is for the industry to carry the burden rather than the individual, who almost invariably is less able to stand it. Our old law has not been entirely just, for the reason that if the corporation or employer was not financially able, a heavy verdict would mean his ruin, or the victim would not be able to be recompensed for his injury.

With the present industrial insurance that we have in this state, the burden is placed upon the industry as a whole, where it rightfully and justly belongs. With this idea in mind, it is our duty to study the experiences and ideas of others, as to the matters of safety, and try to get our apparatus into such shape that it is difficult for a man, who is careless, to get hurt, and also to eliminate that more serious danger, which is that due to momentary forgetfulness. It is impossible for us, of course, to get all apparatus absolutely safe, and the only thing we can do is to impress it upon the minds of the employes that it is expected of them to be careful, and bear in mind constantly, that certain apparatus is dangerous. With apparatus that is very dangerous, the back of a switchboard, for instance, which the writer mentions, because he is more familiar with electrical topics, special precaution should be taken. On small switchboards, it is not practicable to make them as safe as they would be in large plants, where the switches can be put in cells, and all other high voltage conductors well protected, so that it would be difficult to get at them. A switchboard should be fenced off, and at the back of it, there should be a sign, "Danger," "High Voltage," or something of the kind which will constantly impress upon the minds of the operators. This danger sign should be more frequently employed in places where persons have very little occasion to go, because that is a possible source of danger not often heeded. I believe that all wires that are lower than seven or eight feet carrying high voltage currents should be protected in every possible way from accidental contact. The practicability of doing this in all cases, is not well settled.

The writer has in mind one or two cases. In one case, he insulated some heavy bus bars carrying 2300 volts. An official of the company, who had had experience in another company, thought that this was bad practice, and condemned it strongly on the ground that in case of a short circuit, the arc would burn the insulation and cause more destruction of property than would otherwise occur. The writer held in that particular case, the possibility of trouble arising with an insulated bus bar, was greatly reduced; also that there was a source of danger which was of more importance than any destruction to the apparatus of the company, and that was, safety to the operators. The manager held that the operators would have to be careful. A few weeks afterwards, an accident occurred of an unusual nature. An operator was on a ladder, some little distance away; the ladder slipped, and he fell across the insulated bus bar. He escaped without even a scratch. No one will deny the fatal result, had the bar not been insulated. Sometime afterwards, lightning came in there, destroying portions of the switchboard. The arcing that resulted, showed its mark on the switchboard, but the insulated bus bar reduced the extent of the damage. Another source of danger is on oil break switches. At one plant, it was decided not to insulate the switch terminals. The writer, some time after the switches were installed, in examining the back of the board, stumbled, and but for his quick recognition of the danger of touching the terminals of the switch, would have come in contact with them, and as it was, saved himself only by a few inches, by catching the oil tank of the switch. The terminals of the switch were only a few inches apart, and some years afterward, something got between, I believe it was a bat, causing a short circuit, with considerable interruption in the service.

It is hard to insulate the terminals of a great many oil break switches that are now on the market. It is a defect which can be satisfactorily remedied by the manufacturer only. This ought to be impressed upon him as a possible source of danger. It would not be difficult to insulate terminals with a bushing or something of the kind. A bureau or committee for the interchange of experiences, and by calling the attention of the manufacturer to such serious defects that might exist in the apparatus, which is disclosed only by actual experiences, would probably meet with good results. Experience, after all, is the only true test as to whether certain apparatus be safe. A certain type of construction or apparatus is designed by competent and experienced engineers. It is something new in the line, and no pains are spared to insure safety. From an unexpected angle, a source of danger develops.

A bureau or committee, by recording the experiences, and investigating the accidents, would be of invaluable assistance to its members, calling their attention to dangers of a similar nature, that might already exist in their own system.

Working on high tension lines is always a source of well-recognized danger, especially where there are a number of power houses, substations and lines.

The following rules were gotten up for the Elko-Lamoille Power Company, where there are only two plants, a gas engine plant at the receiving end, and a water power plant at the other end, with one line only, connecting the two.

High Tension Line Operation.

The high tension line at all times must be handled as if alive. Great care must be used when turning on the current that no one is working on the line. When current is off line, and men are working on the line, a sign must be hung on the high tension switch both at the power house and at Elko, worded, "Men on line." Turn on current only on orders from ....." (A space is to be left for insertion of a card giving name of party to order current turned on. When orders are given to turn off the current, it must also be stated on whose order it will be turned on. No one's else order can be accepted, except in special cases where the attendant assures himself that the one ordering the current back is a responsible person, and that he has been authorized by the proper party. The power house attendant must assure himself thoroughly on this matter, regardless of who orders the current turned on.

Men on line must always telephone to the power house before touching the line. When informed that it is dead, they must then ground the line properly. The proper way to ground a line is to drive a steel peg about two feet long into the ground with grounding wire attached before going up the pole, then hooking the wire over the line. When connecting to line, hook it solid. Do not touch it to see if it arcs, as you might draw the arc against yourself.

The telephoning and grounding can be dispensed with under certain conditions, namely, if line is completely down and men are sent out in an auto and dropped off every few miles to patrol line. They must, however, have a written order from some responsible person saying that the current will be off. Said person will take down the names of the men authorized to work on the line, and until they are all accounted for, he cannot order the current turned back on the line. The only persons authorized to give orders as above are: G. B. McBride, F. O. Broili and C. A. Stephenson. In no case, however, are the men to be sent out to work on the lines without grounding one or both ends.

The instructions issued by the Public Service Commission of Nevada entitled, "Safety Regulations for Electric Utilities," are made a part of these rules, and all employes must read them carefully, especially paragraphs 6 to 27.

All employes must sign these rules, stating that they have read, and thoroughly understand them.

Joseph Bean, electrical superintendent U. S. Government power plant at Lahotan, Nev., stated that they had had a good deal of trouble on account of using 2300 volts on all the system. This had been finally eliminated by careful attention to grounding and the proper exercise of precautionary measures. On all the outdoor construction work such as on the steam shovels, etc., armored cable was used. Rules had been laid down for the handling of the 16 mile 33,000 volt transmission line to Fallon and in the station the switchboards were properly fenced off.

A. H. Babcock, electrical engineer of the Southern Pacific Company, in closing the discussion, called attention to the fact that there always was a divided responsibility in case of an accident. There always existed the necessity of every operator taking the proper precautions himself and in addition there was the responsibility of the foreman or man in charge of the work. He mentioned the excellent results that had been obtained from the practice of the Southern Pacific Company in holding open meetings to discern the causes and results of every accident of any consequence. When employes realize that they are apt to be called up before a public meeting to account for an accident they are much more apt to use greater caution in their work. Mr Babcock spoke of the recent visit of insurance inspectors to the company's power house in Oakland and although they had planned to spend three or four days going over the station and making recommendations, they found nothing to report on and complimented the company very highly on having covered the safety first work so thoroughly.

At the close of the discussion Prof. Scrugham spoke of the necessity of having a permanent committee of the power companies to discuss local conditions and standardize the practice on many of the questions that are continually rising. He spoke of the necessity of agreeing upon the proper voltage for mine locomotives as one question that is at present alive.

More than 14,000 prisms, to be a part of the illuminating scheme of the Panama-Pacific International Exposition, have reached San Francisco from the Austrian manufacturers and more shipments are expected soon. A total of 125,000 prisms will be used. These will be suspended from the domes and facades of buildings and when the colored rays of powerful searchlights play on them, they will scintillate like precious stones.

The use of electric signs of more or less display qualities is gaining in favor even in the city of Hong Kong, though so far, the extent of such use is limited and the variety of the signs employed comparatively modest. Several of the larger Chinese business establishments, notably the Chinese department stores facing on the water front and the large Chinese restaurants along the water front and in the parts of the city given over to such establishments, are displaying signs of some size and importance, generally in the shape of Chinese characters. Moving signs in the colony so far are confined to alternate shows of color, appearing and disappearing, and other more simple forms of mechanical signs. They represent a big advance over ordinary Chinese signs and advertising signs in this part of the Far East generally, but are in no sense representative of modern mechanical sign advertising. As a rule, Hongkong architecture lends itself fairly well to such displays, even with the limitations noted. Electrical energy is not unduly expensive and the general disposition in the port is toward the use of all such modern aids to business.

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Regarding Electric Lamps

The ultimate efficiency of electric lighting is not yet, neither its complete uses, nor the invention of the equipment by which the ultimate improvement will be made possible. During the carbon lamp age, popular lecturers would often point out the possibilities of increased efficiency of electric lighting, but no one at that time, even in the wildest divagations of fancy, deemed that changes in styles and efficiencies once commenced, would prove so rapid. It is practically impossible, except under business compulsion, for the average man to keep posted.

Changes often emphasize that "the stone rejected of the builders is become the head of the corner." At one time discarded as unsatisfactory, the better viewpoint made possible by invention along other lines, makes the same thing fundamental to further progress.

The basic principles of the carbon filament lamp were all to be found in the then forgotten experimental lamp of Starr who died during the same year in which Edison was born.

Many patented metal filament lamps were abandoned by those responsible for their invention upon the introduction of the carbon filament lamp which could be produced so much more cheaply, only to be again introduced on a quality basis to force the same carbon lamp off the market.

The possibilities are that the carbon filament lamp has not gone out, but that it will be resurrected in a more efficient form.

The use of nitrogen filled lamp bulbs is not altogether new, although it has resulted in such remarkable efficiencies in the light of a new purpose.

As far back as 1883 a patent was granted to Thos. A. Edison covering the introduction of nitrogen into electric lamp bulbs, although for the purpose of preventing the electric discharge between the positive and negative ends of the filament, and it had also been used for the prevention of oxidization of lamp filaments.

This in no way minimizes but rather adds to the credit of those inventors who are able to pierce the veil of limitation and determine actual use, and most complete.

The luminous efficiency of tungsten lamps, even of the so-termed "half-watt" or nitrogen filled lamp is comparatively low, but the limit of the temperature at which tungsten will satisfactorily operate is thought to be already reached.

A really white light from that source is impracticable. At a temperature resulting from operation at 0.20 watts per mean horizontal candle power the filament would last but a few seconds and there are other seemingly insurmountable obstacles. The production of white light would require twice that efficiency.

For this reason it is thought that the incandescent lamp will never entirely displace the various arc lights on an efficiency basis, as arc light efficiencies commence just where incandescent lamps are at their highest.

Dr. Louis Bell, at a recent meeting of the New England Section of the Illuminating Engineering So-

ciety mentioned, that in France an arc light had been produced having an efficiency of 0.175 watts per mean lower hemispherical candle power.

The day has passed when increased efficiencies are a matter of concern to those interested in the sale of energy. New lamps result in newer uses and increased efficiencies in greater current consumption.

It is not expected that the nitrogen filled lamps and the lamps of greater efficiencies will have any effect upon home lighting as they are only made in the larger sizes, but in commercial lighting they will permit the use of artistic effects heretofore excluded on account of high operating costs due to absorption.

The nitrogen filled lamp will undoubtedly find extensive use for locomotive headlights—a service for which it is particularly adapted and one in which it will permit a considerable reduction in operating costs. It will also give better results.

Although the possibility of further increased efficiencies exists it is not the part of wisdom to await them before adopting the best now available. A wise use of that we have is the best preparation for the advent of newer and better ways.

Safety First for Power Companies

Since their inception electric power companies have naturally been practicing the "safety first" idea urged by those laws electrical, which insist on compliance if electricity is to be servant, and not master. In their own interests, therefore, for the protection of the lives of employes, and to prevent waste, power companies have taken whatever precautions were known to be practicable and necessary.

Safety regulations for electric power companies have engaged the attention of national engineering associations and state legislatures.

At the recent Safety Conference held at Reno, Nevada, a paper was presented on this subject, the purpose being to secure uniform practice in the State of Nevada for safety in connection with the use of high voltage lines. Although dealing with Nevada laws on the subject, the paper and its discussion which appear in this issue will prove of intense interest to all electric power companies.

It was shown that only three deaths had resulted in the state of Nevada from contact with high voltage lines since, and including, the year 1911, and that of these, apparently one only was, a layman, and two were linemen. These deaths were due to unusual causes, and would in no way be considered as arguing against the use of high tension lines on public highways.

The hue and cry against the adoption of such high tension transmission, started by fear-mongers preying upon the public mind, in the interest of politics, is silenced by the witness of satisfactory and safe performance.

The vigilance of power companies and the use of protective devices has made these lines absolutely safe.

In high and higher voltage transmission on public highways, there is no need to place any limitation, for there is really nothing to be afraid of but fear.

Although the records show so few accidents in Nevada due to power transmission, the electric power companies in that state have, as a direct result of the conference, formed a commission for the purpose of effecting the adoption of uniform safety regulations throughout the state, for the benefit of the producer and consumer of electricity, and to promote the exchange of experiences in meeting the conditions of local practice.

Safety assurance is largely a matter of education, and the publication of those rules, which in the past have been known to a few, but obeyed, perhaps unconsciously, by all, should serve to still further reduce the possibility of accidents.

Selling Electric Service

There is a general awakening to the fact that the success of the salesman selling electric service is of economic interest to the whole electrical industry, for the more thorough he is, and the greater his all-round efficiency the greater the diversity and quantity of appliances sold, with the consequent increased business for all. His effort in selling electric service creates prospective customers for other commodities.

Although his position as stated is one of such far-reaching importance, the training of salesmen selling electric service has generally been neglected. A few large corporations have for years past carried out more or less comprehensive educational programs but as a rule the training given central station salesmen has been haphazard.

Any individual going onto a job as lineman, for example, but without tools or experience, could hardly be expected to prove a success. The experiment would be hazardous. Yet there are still a great number of men entering the central station field as salesmen, who have little or no conception of the comprehensive extent of the service they would sell. They are nevertheless of necessity sent out to close contracts and build business—that is to sell service—notwithstanding their lack of experience, and, because they do not possess the requisite specialized knowledge, without tools also. The whole industry suffers.

Poor sales-service is far-reaching in other directions, for it may result in a poor load factor with the consequent higher rates and possible dissatisfaction.

The past situation was perhaps due to the rapid growth of the industry. This necessitated the employment of innumerable untrained men. The perfecting of machinery and materials being of such vital importance the perfecting of men—more particularly, salesmen—was neglected. More attention is now being paid to this problem everywhere. It is of vital importance.

There is no necessity for questioning an oracle as to whether the central station business will continue. The air is charged with changes which will make progress even speedier along these lines and call for a more skilled selling.

This need on the part of the central station salesman should result in an aroused interest in electrical progress, for the future is bright with opportunity for the salesman selling electric service, but—he must be aware.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

George A. Hughes, of the Hughes Electric Heating Company, is at Seattle.

Brewster Hall, of the Pass & Seymour Company, was in Seattle recently from San Francisco.

R. J. Kennedy of the American Electrical Heater Company, was at Seattle during the past week.

J. A. Devlin, field inspector, Western Union Telegraph Company, was at Fresno during the past week.

Jas. McCampbell has been appointed general manager of the Tehama Telephone Company, which has been recently re-organized.

Elmer Dover of the H. M. Byllesby Company, returned to Tacoma from the East on February 2d and is now on a visit to California.

Chas. N. Black, vice-president and general manager of the United Railroads, San Francisco, has been elected a director of the Petaluma & Santa Rosa Railroads.

Chas. C. Kutz, sales representative, Plume & Atwood Manufacturing Company, has just returned to San Francisco from a business trip made to Los Angeles and San Diego.

Hal Lauritzen, manager western division for Holophane Works of General Electric Company, has just returned to San Francisco from a rapid trip over his extensive sales territory.

L. F. Austin, of the Austin-McCain Company of Spokane, Washington, has been appointed Jovian Statesman for Spokane. **W. A. Davis,** city electrician, has been appointed alternate.

Miles F. Steel, salesman with Benjamin Electric Manufacturing Company, returned to San Francisco during the past week and has left for a business trip throughout the Pacific northwest.

J. D. Orr has been made district manager of the Idaho Railway, Light & Power Company, with headquarters at Nampa, and has been succeeded by **E. Vinning** as local manager at Caldwell, Idaho.

E. A. Wetmore, Jovian Statesman for Idaho, took advantage of the occasion of the three days convention of the Idaho Society of Engineers, held at Boise, Idaho, on February 5th, 6th and 7th, to attend in order to stimulate interest in Jovianism. **H. F. Holland, J. P. Sprunt** and **E. D. Bacon,** all of Salt Lake City, accompanied Statesman Wetmore, who had arranged for a rejuvenation to be held at the close of the convention.

Edward Watkins, of the Home Electric Company, Tacoma, has sold his business to **William S. Anderson,** formerly assistant manager of the Seattle branch, John A. Roebling Sons Company, **E. I. Salmson** and **J. R. McRae,** who has been employed by the Home Electric Company for the past year. Mr. Anderson will act as general manager and treasurer of the company. The contracting department of the concern will be discontinued and a reorganization perfected along exclusive jobbing lines.

W. R. Putman has been appointed commercial manager for the Utah Power & Light Company with headquarters at Salt Lake City. This position has remained unfilled since **C. Walter Jones** resigned from it a year ago, the work having been divided since that time between employes of the commercial department. Mr. Putman comes to Salt Lake from Rapid City, South Dakota, where for the past two years he has been manager and contract agent for the South Dakota Power Company, a syndicate company operating in several towns in the Black Hills.

J. Q. Brown, for many years in charge of the electrical and mechanical department of the San Francisco-Oakland Terminal Railways, will retire on March 1, and will be succeeded by **George St. Pierre,** at present master mechanic. **John Wells,** purchasing agent of the traction corporation, has been superseded by **P. Laduc. W. E. Hendley,** recently from the East, is organizing and will remain in charge of a new department to be known as the "coasting record department." Mr. St. Pierre's title will be superintendent of equipment and he will have charge only of the mechanical department.

Tasker L. Oddie, Governor of Nevada, is chairman of the new Nevada Safety Commission formed to perpetuate the work started by the Industrial Safety Conference held recently at Reno. The other members of the commlssion are: **V. L. Ricketts,** editor Reno Gazette & Goldfield News; **W. B. Alexander,** secretary Mine Operators' Association; **Geo. A. Bartlett,** attorney for Pacific Power Company; **H. A. Lemmon,** industrial agent, Truckee River General Electric Company; **W. E. Wallace,** legislative agent, Brotherhood of Railroad Trainmen; **Ed. Ryan,** state mine inspector; **J. J. Mullen,** secretary State Industrial Commission; and **J. L. Scrugham,** professor of electrical engineering, University of Nevada.

O. Arnspiger, city engineer, Harrisburg, Ore., was recently elected a member of the Oregon Society of Engineers, together with **D. L. Buckingham,** city engineer, Marshfield, Ore.; **H. C. Brandon,** instructor, Oregon Agricultural College, Corvallis, Ore.; **A. E. Hammond,** civil engineer, Chamber of Commerce, Portland; **L. E. Hinman,** assistant city electrical inspector, Medford, Ore.; **Arthur Kutsche,** building construction engineer, Portland, Ore.; **Edwin H. Kern,** civil engineer, Coquille, Ore.; **Ralph Modjeski,** consulting engineer, Corbett building Portland, Ore.; **Charles S. Noble,** city engineer, Oregon City, Ore.; **Benjamin Ostlind,** engineer and architect, 206 Irving Block, Marshfield, Ore.; **Robert Rea,** civil engineer, Chamber of Commerce, Portland, Ore., and **S. I. Stewart,** manager Lebonon Electric Light & Water Company, Lebonon, Ore.

MEETING NOTICES.

Los Angeles Section A. I. E. E.

The Los Angeles Section of the American Institute of Electrical Engineers will hold a "Throop Night" this month. The entire program will be provided by the students of Throop Institute of Technology. Prof. Sorenson promises an account of some interesting results of original investigations made by members of his class.

San Francisco Electrical Development and Jovian League.

The regular monthly business meeting was held at Tait's last Tuesday when arrangements were made to hold a joint meeting with the Alameda County Electrical Development League at the regular luncheon place on Tuesday, February 17th. All interested are requested to attend. Entertainment will be provided and several addresses have been arranged for.

Arrangements were also made to the end that a representative of the electrical interests be appointed on the board of fire commissioners when the next vacancy occurs. Other important business of interest to League members was also transacted.

Jovian Order at Portland.

The Jovian Order demonstrated their ability "to come back" by an attendance of over 100 at a noon-day luncheon at the Multnomah Hotel, on February 4th. Moving pictures were shown of the Panama Canal and the Los Angeles Aqueduct. The organization now owns a standard portable moving picture booth and will be able to show pictures at all their luncheons if they desire to do so. Mr. Burnett Goodwin of the Northwestern Electric Company acted as chairman. These luncheons will now be made a permanent affair and will take place twice a month, the next one being February 18th at the Multnomah Hotel.

These luncheons are not to be considered for members of the Jovian Order only, but are "an electrical event," and as "big doings" will take place at each, any "True Believer" in "Juice" is welcome.

Seattle Jovian League.

The Jovians met Friday, February 6th, in the Rathskellar Cafe when the after dinner talker was H. F. Tucker, who spent four years as designing engineer of the Panama Canal. During Mr. Tucker's talk it was brought out that electricity will be used extensively for domestic purposes in the canal zone owing to the scarcity of coal as fuel and the large capacity of the plant in the canal zone. Mr. Tucker also stated that in the lighting of the main locks 750 400-watt Mazda lamps will be used. These lamps will be embedded in the concrete walls and the filament of the lamp will be shielded from the pilot's eyes by a concrete hood. It is expected that the first commercial vessels will be allowed to pass through the entire canal on July 1st.

Correction.

In our issue of January 31st we quoted Mr. J. D. Ross, superintendent of the city light plant, as saying at the Seattle Jovian League meeting that the amount of current furnished by the city plant at Seattle was 4½ per cent. This should have been 34½ per cent, the lower figure having been published due to a typographical error.

Utah Electric Club.

The regular weekly luncheon of the Utah Electric Club was held at the Commercial Club Thursday, February 5th, at 12:30. The social and entertainment committee reported that they have arranged for a smoker to replace the regular weekly luncheon next week. Several good wrestling and boxing bouts are scheduled in addition to some of the best vaudeville by local and professional talent.

On this occasion the regular speaker of the day was Simon Bamberger, president of the Salt Lake & Ogden Railway Company—the Bamberger line. Mr. Bamberger went to work on the construction of the Union Pacific at Piedmont, and remained with the construction gangs until the junction of the Union Pacific and the Central Pacific was effected at Ogden. His reminiscences and personal experiences were extremely interesting.

Southern California Electrical Development and Jovian League

Ira J. Francis and associates, with the John A. Roebling's Sons Company, were hosts to the Jovian Electrical League of Southern California on Wednesday, February 4, 1914. Almost 200 members of the League assembled at the new plant of the company, at 216 South Alameda street, and partook of luncheon and inspected the plant and warehouse. where every modern convenience for handling the stock has been installed. Mr. Francis made a brief talk on the development of the Roebling interests in Los Angeles under his direction, starting out with an office which was aptly termed "nothing much but a Derby hat," until today, when they occupy the greater part of the flat iron block bounded by Alameda street, Stephenson avenue and Third street. The building is a substantial three-story structure of re-enforced concrete. The members were entertained by the Ad Club quartet, which rendered some fine vocal numbers.

Oregon Society of Engineers.

At the annual dinner of the Oregon Society of Engineers which took place on Monday evening, February 2, 1914, in the Blue Room of the Multnomah Hotel, Portland, Oregon, the following officers were elected: E. G. Hopson, vice-president; Henry Blood, treasurer (re-elected); Orrin E. Stanley, secretary (re-elected); and T M. Hurlburt, Russell Chase, J. P. Newell, directors. The members of the nominating committee named are as follows: S. B. Clark, B. C. Ball, C. A. Merriam, C. J. Hogue, Edwin A. Taylor, R. E. Kremers, E. I. Cantine, F. F. Henshaw..

About 70 covers were laid and quite a number of the members were accompanied by their wives. During the dinner several vocal solos were rendered for the members' and guests' entertainment. The speakers of the evening were: W. E. Coman, general manager of the Northwestern Electric Company, who discussed mainly the beneficial effects the operation of the Panama Canal will ultimately have upon the growth and prosperity of the North Pacific Coast. Franklin I. Griffith, president of the Portland Railway, Light & Power Company, made a plea for home products and an appeal for fair play on the part of the public toward the public utility corporations, about which, he said, there was no mystery, any more. W. H. Graves, president of the Oregon Society of Engineers, gave a masterful and intensely interesting address in which he brought out the reasons why membership in the Society should be sought; dwelt upon its activities and value and gave a comprehensive dessertation upon the duties of the engineer and his place in the social order. The address was enjoyed and appreciated by all those who had the pleasure of hearing it.

Addresses were made by P. L. Campbell, president of the University of Oregon, and W. V. Gates, owner of the water plant at Dallas, Oregon.

The secretary's report showed the society to be in a flourishing condition as regards membership and funds.

JOVIAN REJUVENATION AT LOS ANGELES.

Statesman J. N. Colkitt held a successful rejuvenation of the Jovian Order at Los Angeles on February 6th. Among the 29 candidates initiated were some of the most prominent electrical men of the city.

The rejuvenation was preceded by a dinner at the Union League Club. During the dinner several startling entertainment features were introduced which added greatly to the jollity of the occasion. Statesman Colkitt, after telling of the purposes of Jovianism, introduced A. E. Morphy as toastmaster. Geo. A. Damon spoke on the future of Los Angeles. Carl Heilbron told of the wonders of San Diego. Miles F. Steel, Statesman-at-large, answered the toastmaster's repartee in kind. A. H. Halloran outlined some of the plans of the Commercial Division and B. F. Pearson was spokesman for the candidates.

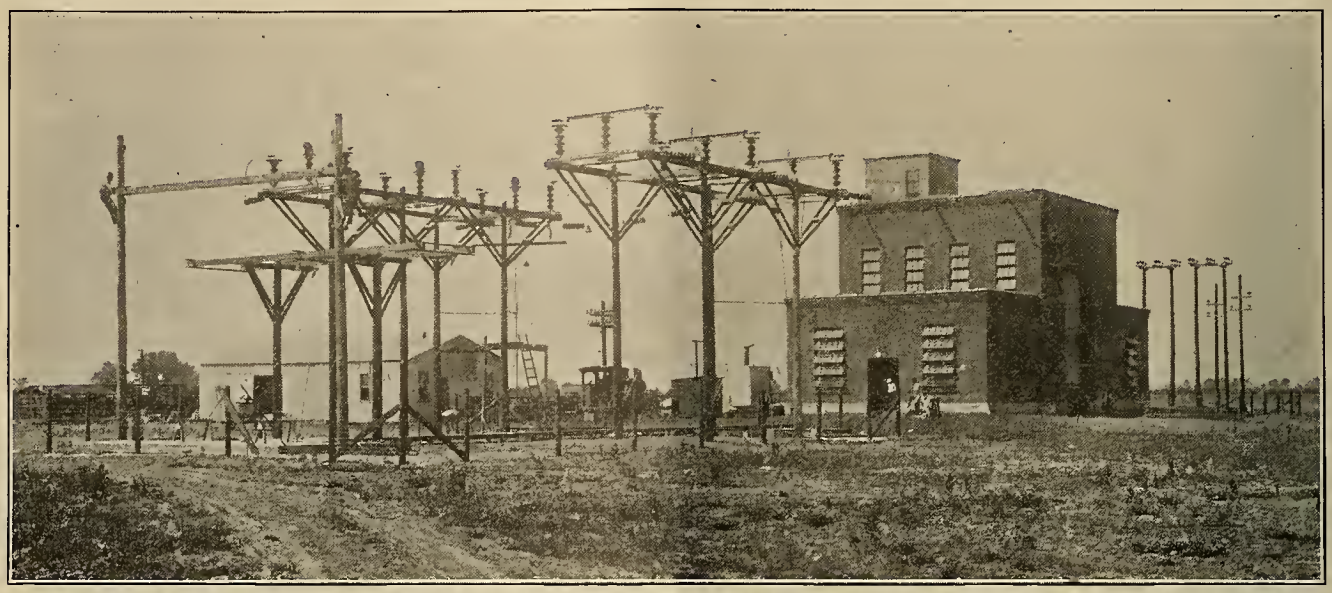
At the rejuvenation Statesman-at-large J. G. Pomeroy presided as Jupiter in his usual efficient manner. The rendition of the ritual was most excellent, as all the members of the permanent degree team had memorized their parts. The following officiated:

Jupiter, J. G. Pomeroy.
Neptune, J. H. Pieper.
Pluto, T. E. Burger.
Vulcan, L. E. Darrow.
Hercules, H. L. Miller.
Mars, A. L. Spring.
Apollo, C. C. Young.
Avrenim, J. M. Morris.
Mercury, D. H. Conover.
Imps: C. D. Lamoree, D. K. Barris, W. J. Bannon, B. C. Chase, W. R. Edwards, A. C. H. Jacobmeyer, S. T. Snow.

Those made rejuvenated beings are as follows:

Henry P. Clarke, Mechanical and Electrical Engineer, Hamburger's Department Store.
H. A. Hoagland, Hoagland, Hulse Electrical Company.
B. F. Pearson, General Superintendent, Southern California Edison Company.
C. H. Heilbron, President and General Manager, Southern Electrical Company, San Diego.
H. J. Alexander, Salesman, John A. Roebling Sons Company.
John E. Wilson, J. E. Wilson Electrical Company.
Parker C. Reid, Salesman, John A. Roebling Sons Company.
Clifton Peters, Clerk, Southern California Edison Company.
L. C. Fay, Westinghouse Electric & Manufacturing Co.
R. H. Sterling, Property Agent, Southern California Edison Company.
R. B. Rands, Sales Agent, U. S. Steel Products Company.
A. N. Johnson, President, Pacific Electrical Construction Company
G. B. Capps, Secretary, Faulkes-Gaylord Company.
J. M. Mullins, Manager, Crescent Electrical Company.
E. B. Clay, Owner, E. B. Clay.
H. C. Tilden, Power Salesman, Southern California Edison Company.
L. A. Hobbs, Salesman, Western Electric Company.
T. S. Halloran, Salesman, Hughson & Merton.
W. E. Oliver, Assistant District Agent, Southern California Edison Company.
W. L. Deimiling, District Agent Southern California Edison Company, Santa Ana.
A. B. Gentry, Greenwood Adv. Company.
J. E. Cope, Manager, Cope Electrical Company, Santa Ana.
Walter S. Sweet, Salesman, Illinois Electrical Company.
M. V. Simpson, Manufacturers' Agent.
W. B. Tavenner, Salesman Western Electric Company.
R. F. Foulkes, President and General Manager, Foulkes Electrical Company.
C. B. Hubbs, Pacific Light & Power Company.
Frank H. Smith, Clerk, Pacific Light & Power Company.
R. E. Ellis, Assistant Engineer M. of W., Pacific Electric Railway.

INDUSTRIAL



Hulls Substation, Showing Outdoor 100,000 Volt High Tension Disconnecting Switches in Foreground.

HIGH TENSION SWITCHING EQUIPMENT.

The pre-eminence of the Pacific Coast in hydroelectric development, with the consequent increase in the voltage of high tension transmission, in order to bring the power of the farthest site to the centers of useful distribution, has caused local industries to be born which could immediately produce the necessary equipment for these new and higher voltage lines.

Though created to meet an immediate local need the quality and importance of the product of these factories may be measured by the fact that the use of similar transmission systems throughout the country has often resulted in the adoption of this special equipment of western manufacture.

Some of the first difficulties encountered in the higher voltage transmission systems on the Pacific Coast were due to the lack of proper switching equipment. The design and building of switches locally has as a result, grown into a permanent and thriving industry.

The Pacific Electric Manufacturing Company, San Francisco was formed in 1906 for this purpose, and immediately commenced the manufacture of the Baum switch and other types, which have been developed from comparatively crude originals into standard products used throughout the United States.

It is a credit to California engineering that the lines of the Great Mississippi River Transmission system, from Keokuk to St. Louis, are equipped with 100,000 volt, 60,000 volt and 35,000 volt line switches manufactured by this company. The line switches of the Hulls substation of the Mississippi River Power Company, which are here illustrated, the



Shipment of 50 Pacific Electric 13,000 Volt Switches for Southern California Edison Company.



Pacific Electric 100,000 Volt Automatic Oil Switch—Port Marion Switching Station—Sierra & San Francisco Power Co.

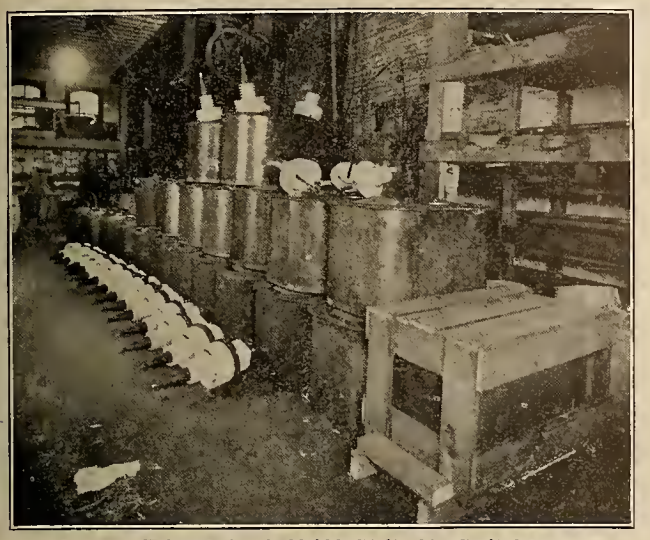
100,000 volt switches of the Alabama Power Company, and of the Great Western Power Company, are also the product of this factory, as are the 100,000 volt oil switches of the Sierra & San Francisco Power Company's transmission line's switching stations and many of their substations.

The Pacific Electric Manufacturing Company's activities are by no means confined to the higher voltages, as the accompanying photograph of fifty 13,000 volt switches, forming one-eighth of the orders received from the Southern California Edison Company for the year 1913, will show. The Southern California Edison Company has adopted this type of switch exclusively for its 13,000 volt service, and has invited the Pacific Electric Manufacturing Company to refer to them, any prospective purchasers, or others who may be interested.

The following illustration is of part of a shipment of 60,000 volt oil switches to the Peninsular Power Company to

Michigan. This shipment and the other switches which complete the order, form the third order placed for these switches by this company, and associate companies in Michigan and Wisconsin.

To those who are familiar with the switches of seven or eight years ago, the many improvements and developments



Part of Shipment of 60,000 Volt Oil Switches for Peninsula Power Co., Michigan.

in the Pacific Electric Manufacturing switches will show an interesting development.

This firm was the first Pacific Coast factory engaged in the exclusive manufacture of oil and poletop switches and their product is used in over eighty per cent of Pacific Coast power transmission systems.

UNIQUE POWER PLANT FOR FORD MOTOR COMPANY.

The Ford Motor Company has placed contracts for a gas engine-electric power plant that will be not only one of the largest in the country but in many respects absolutely unique. The company has appropriated in the neighborhood of a million dollars for the project, which will put into effect plans Mr. Henry Ford has long had in mind for utilizing the waste heat of the ordinary producer gas engine.

Four 6000 h.p. Hamilton-Gray gas engines of novel design will drive the same number of Crocker-Wheeler 3750 kw., 250 volt, 80 r.p.m. engine type direct current generators These will be the largest capacities on record for generators of this type. A plan view of each engine will be similar to a cross compound steam engine, with two cylinders in tandem on each side. One pair of cylinders will be operated by producer gas and the other by steam. The steam will be generated from the water used in the water jacket of the gas engine, further heated by the exhaust gases and by waste heat from the producer gas plant. This water or steam will be used as the feed water for the boiler which supplies the steam engine cylinders. A heavy fly wheel will equalize the characteristics of the gas and steam driven elements of the engine. Each of the generators will have a normal rating of 3750 kw.

These generators are designed for much higher efficiency than ordinarily found in commercial practice. Full load efficiencies will be not less than 94½ per cent. By these means and by the utilization of energy usually lost in waste heat, it is expected to make the new Ford power plant the most economical in the country in respect to cost of production per kilowatt hour.

The armatures will be of split construction which is necessitated by clearance requirements through tunnels and bridges in shipment from Ampere to Detroit, and the generators will be finally assembled at the Ford Plant.

HYDROELECTRIC DEVELOPMENT IN ALASKA.

During the past year the Westinghouse Electric & Manufacturing Company has undertaken a number of contracts for hydroelectric development in Alaska that will do much to improve mining conditions in that territory.

The most important of these is the new generating unit for the Alaska Treadwell Gold Mining Company to be installed in the Nugget Creek Development. This unit will consist of a 2350 k.v.a. waterwheel generator driven by a Pelton water wheel running at 300 revolutions per minute. This unit will give the mining company about 3000 additional h.p. A 50 kw. motor generator exciter set with special shaft so that the unit may be water wheel driven when desired is also included.

A contract has also been recently closed for a 300 k.v.a. water wheel generator to be installed by the Chicagoff Mining Company, one of the Guggenheim interests operating near Sitka. This generator will be used to supplement the mining company's present installation which consists of 127½ kw. With the generator in question there were also ordered the necessary step-up and step-down transformers for transmitting the energy at high voltage from the power plant to the mines.

During the summer the Kennecott Mines Company, operating one of the highest grade copper mines in the world, located in the Copper River district, purchased a 200 k.v.a. water wheel generator, together with all the necessary switchboard and accessories. This water power plant will supplement a steam driven power plant now being operated by the mining company and containing one 400 k.v.a. generator and one 50 kw. generator.

A considerable number of electric motors for mining and milling operations were purchased with the above generators.

In addition to the above, the Alaska Juneau Gold Mining Company of Juneau, Alaska, recently purchased from the Westinghouse Electric & Manufacturing Company a 1012 k.v.a. water wheel generator to be driven by a Pelton wheel, the energy from which will be used to supplement that of a 937 k.v.a. steam turbine.

BOOK REVIEWS.

The Lighting Book. By F. Laurent Godinez; 109 pp.; size, 6 in. by 9½ in.; profusely illustrated from photographs: cloth bound. Published by McBride, Nast & Company, New York, and for sale by The Technical Book Shop, Rialto Bldg., San Francisco. Price, $1.25.

Written for the layman, this book, with but a little additional care, could have been made still more valuable to the architect, fixture dealer and practicing illuminating engineer. As it is, The Lighting Book contains much interesting information to all, on the subject of home lighting. Unfortunately, the author has a grouch, and his spleen is apparent in page after page which he thereby spoils. Masquerading in an entirely unsuited skin, he throws himself in front of the juggernaut car of a necessary commercial efficiency in a futile attempt to halt its progress. Furthermore, he sets up the puppet of an "illuminating engineer"—an early conception and disillusioned—and pelts it with the pellets of a contemptuous phraseology. "When you call a man a bad name," says Elbert Hubbard, "you are that bad thing." Mr. Godinez should forget the old and draw for the reader a pen picture of the now, and of his present self. So would the reader, layman and other, obtain a better, broader, brighter and more just conception of the profession of illuminating engineering which, together with the efforts of the much abused manufacturers of illuminating glassware, has contributed so vastly to the use of better lighting methods not only in the home, but in general. Even at that, the book is well worth studying, only—keep your myotic eye on the paragraphs with the grouch.

NEWS NOTES

INCORPORATIONS.

RICHLAND, WASH.—The Richland Telephone Company, $5000. Incorporated by E. E. Floyd, J. R. Gardner, Wm. Read and others.

CENTRALIA, WASH.—The South Hanaford Farmers Telephone Company. The incorporators are I. M. Pollack, F. R. Lobdell and others.

SEQUIU, WASH.—The Sequiu Mutual Telephone Company, $5000, by E. Roberts, Lou Goldsmith and P. A. McNamara, incorporators.

FINANCIAL.

PORTLAND, ORE.—The Pacific Light & Power Company, owner of many gas, electric light and power plants in the northwest, has filed a mortgage for $30,000,000 given to the United States Mortgage & Trust Company of New York City. This covers the company's properties in the northwest.

BOISE, IDAHO.—At auction $215,000 Idaho Railway, Light & Power Company first and refunding mortgage 5 per cent bonds and $388.26 scrip, 2454 shares Idaho Railway, Light & Power Company common voting trust certificates and $93.98 scrip, 572 shares of Idaho Railway, Light & Power Company preferred voting trust certificates and $58.19 scrip, $471.06 Boise, Payette River Electric Power Company 6 per cent bond scrip and $1000 Idaho, Oregon Light & Power Company first refunding 6 per cent bonds certificates of deposit and $721.80 scrip sold for $110,000 the entire lots. Idaho Railway, Light & Power Company organized in 1912 to acquire electric railway and lighting and power properties in Idaho, was placed in the hands of receivers in December. The company controlled the Boise & Interurban Railway, the Boise Railroad Ltd., Boise Valley Railway, the Caldwell Power Company, the Dewey Electric Light & Power Company and the Swan River Power Company. It also controlled the Idaho-Oregon Light & Power Company, which was placed in receivership in November and is now in process of reorganization.

ILLUMINATION.

SAN FERNANDO, CAL.—John T. Wilson has completed arrangements to rebuild his entire electric light system, same to be made up-to-date in every way.

McMINNVILLE, ORE.—The light and water commission has favorably passed on the application of the petitioners for electric service in the Fairview neighborhood.

SANTA ROSA, CAL.—At the last meeting of the Sonoma county trustees Fred Bulotti and R. E. Murphy applied for permission to use certain streets for conducting gas pipes.

ROSWELL, N. M.—A proposition for removal of the poles and wires of the telephone and electric light companies in the paved districts is under consideration by the city council.

WINNEMUCCA, NEV.—The board of commissioners on March 2d will hear the application of J. B. Fayant for a franchise to construct and operate electric light and power lines in the town of Golconda.

MARTINEZ, CAL.—A gas supply for Martinez is assured by Waldo Coleman, who applied to the city trustees for a franchise for the extension of his distributing mains under the public streets and alleys to all parts of the municipal domains.

MOAB, UTAH.—A petition for a franchise to erect and maintain an electric lighting system within this city was presented to the town board at its meeting last week by C. A. Hammond. The petition was laid over for one week for consideration.

RIVERSIDE, CAL.—Plans for a lighting system on Seventh street have been revived and have been approved by the public utilities board, and are now in the hands of the public utilities committee for investigation and report. The plans call for ornamental 3-light standards from Rubidoux to Santa Fe depot.

CHILLIWACK, B. C.—The town has entered into a ten-year contract with the British Columbia Electric Railway Company, light and power department, who will install 100 candle power tungsten lamps on the streets and maintain them for $18 a year up to one a. m. each night and for $27 per year if an all night service is desired.

TONOPAH, NEV.—The State Public Service Commission has reduced electric light and power rates in Southern Nevada from 5 to 50 per cent and the meter deposit cut from $10 to $5, effective March 5th. The domestic rate has been 18c per kw.-hr. The lines are owned by the Nevada-California Power Company, with headquarters on Bishop Creek, Cal.

BLACKFOOT, IDAHO.—The city council of Blackfoot is seeking a suitable site for a municipal lighting and power plant. One site on the Blackfoot River has been favorably reported. Offers have been made by power companies at Ashton and Idaho Falls to furnish current for power and light, but the council is desirous of installing a plant to be owned by the city.

CARLSBAD, N. M.—The Arkansas River Bed Oil & Gas Company of Cushing, Oklahoma, has applied to the city trustees of Carlsbad for a franchise for furnishing the town with gas for domestic, lighting and manufacturing purposes. The company agrees to pipe gas from wells in Oklahoma oil fields across the state of Texas and to have gas in Carlsbad in fifteen months. The council has the matter under advisement.

LOS ANGELES, CAL.—All the old directors and officers of the Los Angeles Gas & Electric Company were re-elected at the annual meeting of this company. The directors are W. B. Cline, Wm. M. Van Dyke, Wm. Baurhyte, C. P. Houghton, C. S. Vance, C. O. G. Miller, and A. Schilling. Following their election by the stockholders, the directors met and chose the following officers for the company: W. B. Cline, president; Wm. Baurhyte, C. P. Hougton and C. S. Vance, vice-presidents; R. M. Adams, secretary and treasurer; T. P. McCrea, assistant secretary and Horace Cline, assistant treasurer.

POINT GREY, B. C.—Messrs. DuCane, Dutcher & Company, consulting engineers, Vancouver, have prepared a preliminary report for the municipality of Point Grey, relative to the establishment of a municipal power plant and distribution system in that district at a cost of approximately $240,000, this expenditure to be spread oyer a two year period. The report favors provision being made for a plant designed to act as a reserve and substation for hydroelectric power, and recommends accommodation for a Diesel oil engine and a steam turbine plant with oil fuel boilers, the oil engines to be utilized for lighter loads. The distribution system proposed provides for the erection of pole lines in the outlying parts of the municipality and an underground system in the Shaughnessy Heights district. It is understood that the recommendations of the engineers will be brought up for discussion at an early meeting of the Point Grey council—probably early in February.

TRANSMISSION.

BANNING, CAL.—The Southern Sierras Power Company is conducting a transmission line from Banning to El Centro and expects to have same in operation within sixty days.

SAN FRANCISCO, CAL.—The city attorney has advised the supervisors that it will be proper to grant the Sierra & San Francisco Power Company a permit to lay underground pipes, wires and conduits in certain streets embraced within the Exposition grounds, on which the company now has the right to maintain overhead poles and wires.

LOS ANGELES, CAL.—The power companies have received the draft of the tentative agreement to be made with the city, providing for the lease and ultimate purchase of the distributing systems. The companies have been given until February 16th, to accept or reject the contract, which provides for complete control and operation by the city.

SEATTLE, WASH.—The county commissioners have granted to the city of Seattle a franchise covering the furnishing of light and power in the south district, operative for fifty years. The district is the same as that recently awarded to the Puget Sound Traction, Light & Power Company, and will be occupied jointly under a common user clause in the franchises. The city will be required to pay one-half the cost of installation of the pole line. In addition to the fifty additions, eleven county roads and five streets in the south district, the city and the traction company will jointly occupy the Lake Forest Park district, north of the city.

PORTLAND, ORE.—The Northwestern Electric Company has requested the city council to declare void the $100,000 bond given on the understanding with the city that when $350,000 had been expended the bond could be withdrawn. The ordinance granting the company its franchise was passed September 25th and the company put up its bond shortly afterward. According to a communication received from W. E. Coman, vice-president and general manager of the company, a total of $435,000 has been expended, $236,091 for the plant in the Pittock block, $71,957 for the Alhina substation and $145,235 for the overhead and underground system.

BOISE, IDAHO.—The Idaho Public Utilities Commission is investigating the application of the Idaho Power & Light Company to enter the southeastern part of the state in competition with the Great Shoshone & Twin Falls Water Power Company in the Twin Falls district and the Southern Idaho Power Company in the Pocatello district. These two latter companies are controlled by the Kuhn interests, and have been supplying the electric light and power service of this rapidly growing territory. The Idaho Power & Light Company is controlled by Mr. L. L. Nunn. They have recently erected a plant on the Malad River and are seeking to enter the territory of the older companies, who are arguing in defense, that the territories served by them are supplied with sufficient electrical energy, and that if more is needed they are in a position to supply it.

EUREKA, UTAH.—Electricity is gaining in favor with the mining operators of the Tintic Mining District, and it is expected that during 1914 a number of companies will electrify their hoisting plants. The Eureka Reporter publishes figures submitted at the last meeting of the Victoria Mining Company, which shows that the electrification of the plant at their mine resulted in a saving of approximately $4500 per year. According to the statement for the year 1912, when the Victoria mine was operating a steam hoisting plant, the sum of $6589.56 was paid out for coal, and the expense attached to delivering it at the property; and for 1913 the company's expense for electricity was but a trifle in excess of $2000. This remarkable showing for the electrically operated hoisting plant has stimulated an interest in the electric proposition, and many of the other mines are investigating the advisability of changing from steam to electric power, including the Eagle and Blue Bell, Chief Cousolidated and Grand Central.

REDDING, CAL.—A case that has been in the superior court for six years was settled when Judge Barber entered judgment by stipulation of all the parties concerned. The judgment is in the nature of a compromise. Parties to the suit are the Shasta Power Company, which has since been absorbed by the Northern California Power Company. The long list of defendants includes nearly every farmer living on Hat Creek in the eastern part of the county. The suit involved the right to use the waters of Hat Creek and Lost Creek. When the Shasta Power Company was organized it laid claim to 700 inches of water in Hat Creek and Lost Creek and dug a ditch conveying the water to its power plant on Snow Creek. Thos. B. Walker and others interested in farming land on Hat Creek, sued the company for damages and asked for an order restraining the company for diverting the water. The judgment now rendered allows the Shasta Power Company, or its successor, the Northern California Power Company, to divert the water only from the 15th day of September to the first day of the following May. From May 1 to September 15, or during the irrigation season, the farmers are to have the water exclusively. The company is enjoined from taking any water at any time from East Hat Creek. The farmers release all claims for damages.

TRANSPORTATION.

MILL VALLEY, CAL.—An ordinance has been passed granting to the Marin County Electric Railways a street railroad franchise along certain streets in this town.

BREMERTON, WASH.—An urban and interurban railway franchise from here to Hood Canal points has been granted to Gustav F. Rust, 834 Henry building, Seattle, subject to ratification by the voters.

PORTLAND, ORE.—The Portland & Oregon City Railway, unable to build its proposed line on East Seventeenth street, because of the referendum which recently was invoked on its franchise, has applied to the council for a new franchise over an entirely different route. It will be about two months before this application can be considered.

PORTLAND, ORE.—Extension of the United Railways to Banks is now receiving the serious consideration of L. C. Gilman, president of the road. The terminal of the road is Wilkesboro, about a mile from Banks. The right of way over most of the distance was secured four years ago with the understanding that the road was to be extended.

STOCKTON, CAL.—Subscription lists to secure the extension of the El Dorado street car line to Castle street, thence west to Tuxedo Park, are being circulated. It will cost something like $250,000 to build this extension. Of that amount the Stockton Electric Railway Company is asking those whose holdings will be enhanced by the extension to provide $100,000.

SALT LAKE CITY, UTAH.—Permission has been granted by the city commission to the Salt Lake Terminal Company to erect a temporary structure at the intersection of First West and Third South streets to be used temporarily as a depot by the Orem electric line, pending the completion of the Union interurban station which is contemplated by the Orem and Bamberger lines.

PETALUMA, CAL.—Directors of the Petaluma & Santa Rosa Railroad, at the annual meeting last week, discussed plans for an extension of the system north from Santa Rosa. The first section to be built would be between Santa Rosa and Healdsburg, but there is contemplated construction of additional trackage aggregating 50 miles. "Whether or not this extension will be made is to a large extent dependent upon the attitude of the people whose interests it is to serve," said Secretary McMurray. "If we receive the proper encouragement the improvements will be made without delay." The officers were all re-elected.

ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page opposite

A-1 American Ever-Ready Co.
Los Angeles; 755 Folsom Street, San Francisco; Seattle.

B-1 Benjamin Electric Manufacturing Co.
Rialto Building, San Francisco.

B-2 Berkeley Electric Cooker Co.
1932 Center Street, Berkeley.

B-3 Blake Signal and Manufacturing Co. 14
680 Howard Street, San Francisco.

B-5 Bridgeport Brass Co. 3
(See Pierson, Roeding & Co.)

C-1 Century Electric Co. 3
614 So. Grand Ave., Los Angeles; Salt Lake City; 56 Natoma Street, San Francisco; Seattle; Spokane.

C-2 Crocker-Wheeler Co. 11
Title Insurance Bldg., Los Angeles; Salt Lake City; First National Bank Bldg., San Francisco; Seattle.

C-3 Cutler-Hammer Manufacturing Co.
579 Howard Street, San Francisco.

D-1 D. & W. Fuse Co.
(All Jobbers.)

D-2 Dearborn Drug and Chemical Works 11
355 East Second Street, Los Angeles; 301 Front Street, San Francisco.

E-1 Edison Lamp Works of General Electric Co.
(See General Electric Company.)

E-2 Edison Storage Battery Supply Co. 11
441 Golden Gate Avenue, San Francisco.

E-3 Electric Agencies Co.
247 Minna Street, San Francisco.

E-4 Electric Storage Battery Co.
Pacific Electric Building, Los Angeles; Spalding Building, Portland; 118 New Montgomery Street, San Francisco; Colman Building, Seattle; Pacific Building, Vancouver.

F-1 Fairbanks, Morse & Co.
Los Angeles; Portland; 651 Mission Street, San Francisco; Seattle; Spokane.

F-2 Fort Wayne Electric Works of G. E. Co.
Rialto Building, San Francisco; Colman Building, Seattle.

G-1 General Electric Co. 17-18-19
124 W. Fourth Street, Los Angeles; Worcester Building, Portland; Rialto Building, San Francisco; Colman Building, Seattle; Paulsen Building, Spokane.

H-1 Habirshaw Wire Co.
(See Western Electric Company.)

H-2 Hemingray Glass Co. 11
330 So. L. A. Street, Los Angeles; 345 Oak Street, Portland; 807 Mission Street, San Francisco.

H-3 Hoagland-Hulse Electric Co.
1707 Naud Street, Los Angeles.

H-4 Hunt, Mirk & Co.
141 Second Street, San Francisco.

I-1 Indiana Rubber and Insulated Wire Co. 14
807 Mission Street, San Francisco.

K-1 Kellogg Switchboard and Supply Co.
Aronson Building, San Francisco.

K-2 Keystone Boiler Works.
201 Folsom Street, San Francisco

K-3 Klein & Sons, Mathias. 20
579 Howard Street, San Francisco.

K-4 K-P-F Electric Co.
37 Stevenson Street, San Francisco.

L-1 Leahy Manufacturing Co.
Eighth and Alameda Streets, Los Angeles.

L-2 Locke Insulator Manufacturing Co. 20
(See Pierson, Roeding & Co.)

M-1 Mannesmannrohren-Werke
Rialto Building, San Francisco.

M-2 McGlauflin Manufacturing Co.
Sunnyvale.

M-3 Moore & Co., Charles C. 5
Van Nuys Building, Los Angeles; Spalding Building, Portland; Kearns Building, Salt Lake City; 40 First Street, San Francisco; Mutual Life Building, Seattle; Santa Rita Hotel Building, Tucson.

N-1 Nason & Co., R. N.
151 Potrero Avenue, San Francisco.

N-2 National Conduit & Cable Co., The
Trust and Savings Building, Los Angeles; Rialto Building, San Francisco.

N-3 National Lamp Works of G. E. Co. 15
(All Jobbers.)

N-4 New York Insulated Wire Co. 11
629 Howard Street, San Francisco.

N-5 Norris Co., L. A.
Monadnock Building, San Francisco.

O-1 Okonite Co. 20
(All Jobbers.)

P-1 Pacific Electric Manufacturing Co.
80 Tehama Street, San Francisco.

P-2 Pacific States Electric Co. 2
526 So. L. A. Street, Los Angeles; 90 Seventh Street, Portland; 526 Thirteenth Street, Oakland; 575 Mission Street, San Francisco; 307 First Ave., So., Seattle.

P-3 Parker Boiler Co.
201 Folsom Street, San Francisco.

P-4 Pelton Water Wheel Co. 11
2219 Harrison Street, San Francisco.

P-5 Pierson, Roeding & Co. 3-20
Pacific Electric Building, Los Angeles; Spalding Building, Portland; Rialto Building, San Francisco; Colman Building, Seattle; Pacific Building, Vancouver.

P-7 Pittsburg Piping & Equipment Co. 20
Monadnock Building, San Francisco.

S-1 Schaw-Batcher Company, Pipe Works, The. 11
211 J Street, Sacramento; 356 Market Street, San Francisco.

S-2 Simonds Machinery Co.
12 Natoma Street, San Francisco.

S-3 Simplex Electric Heating Co. 12
612 Howard Street, San Francisco.

S-4 Southern Pacific Co. 14-16
Flood Building, San Francisco.

S-5 Sprague Electric Works of G. E. Co. 14
Rialto Building, San Francisco; Colman Building, Seattle.

S-6 Standard Underground Cable Co. 20
Union Trust Building, Los Angeles; First National Bank Building, San Francisco.

S-7 Staples & Pfeiffer.
102 Steuart Street, San Francisco.

T-1 Thomas & Co., R.
(See Western Electric Co.)

V-1 Van Emon Elevator Co.
56 Natoma Street, San Francisco.

W-1 Wagner Electric Manufacturing Co. 11
Rialto Building, San Francisco.

W-2 Western Electric Co.
119 East Seventh Street, Los Angeles; 507 Sixteenth Street, Oakland; 680 Folsom Street, San Francisco; 1518 First Avenue, So., Seattle.

W-3 Westinghouse-Church-Kerr Co.
Pacific Electric Building, Los Angeles; Pacific Building, San Francisco.

W-4 Westinghouse Electric and Manufacturing Co. 4-6
Lewisohn Building, Butte; Van Nuys Building, Los Angeles; Couch Building, Portland; 212 So. W. Temple, Salt Lake City; 165 Second Street, San Francisco; Central Building, Seattle; Paulsen Building, Spokane.

W-5 Westinghouse Machine Co.
141 Second Street, San Francisco.

W-6 Westinghouse Lamp Co.
(See Westinghouse Electric and Manufacturing Co.)

W-7 Weston Electrical Instrument Co. 3
682 Mission Street, San Francisco.

W-8 Western Pipe & Steel Co.
444 Market Street, San Francisco; 1758 North Broadway, Los Angeles.

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the act of Congress March 3, 1879.

VOL. XXXII NO. 8 SAN FRANCISCO, FEBRUARY 21, 1914 PER COPY, 25 CENTS

HYDROELECTRIC PLANT COST CONSIDERATIONS.
BY J. C. RALSTON.

P. P. I. E. EXHIBIT SPACE FREE.

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OUTDOOR INDIRECT LIGHTING.

PLANNING LIGHTING INSTALLATIONS.
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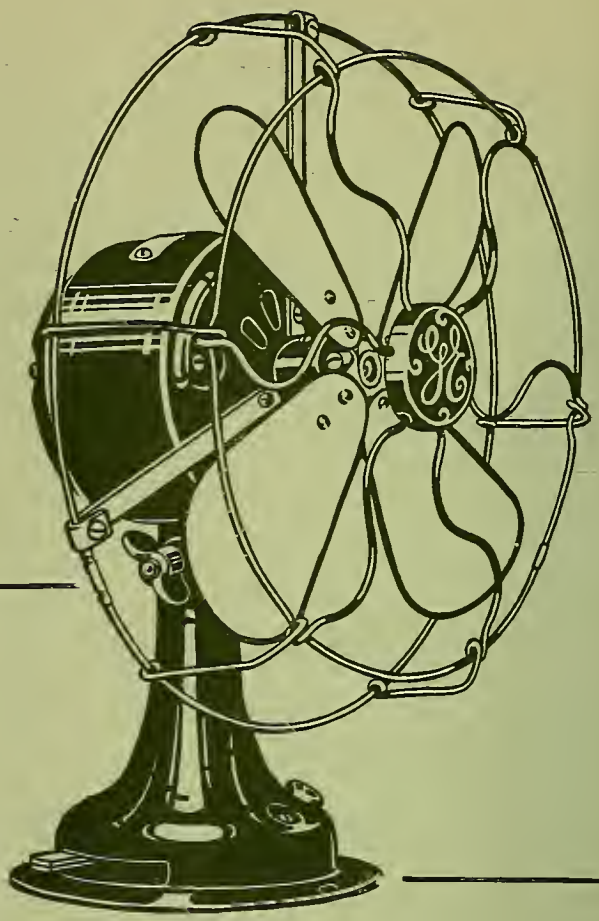
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Summer
will soon be here

It's not a bit to early
to be thinking



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Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXII | SAN FRANCISCO, FEBRUARY 21, 1914 | NUMBER 8

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HYDROELECTRIC PLANT COST CONSIDERATIONS

BY J. C. RALSTON.

(This syllabus or specification for the preparation of an estimate of cost of a hypothetical hydroelectric plant to serve, under municipal operation, a western city of 125,000 population, which it is assumed is already well served by a public utility corporation, was presented by Mr. Ralston who is a member, American Society of Civil Engineers, and a consulting engineer, Spokane, Wash., at a joint meeting of the Spokane Section, A. I. E. E.; Spokane Chapter, A. S. C. E.; Columbia Section, A. I. M. E.; and the Faculties of Engineering, and engineering students of the University of Idaho and Washington State College, held at Moscow, Idaho, January 17, 1914.—The Editors.)



Waterpower Is a Result Only of Development.

Assumed: A western inland city, population 125,000, now served by a public utilities corporation which of necessity for a city of this size would have two or more hydroelectric power plants, interconnected, and having a commensurate steam auxiliary power plant and a large storage battery plant.

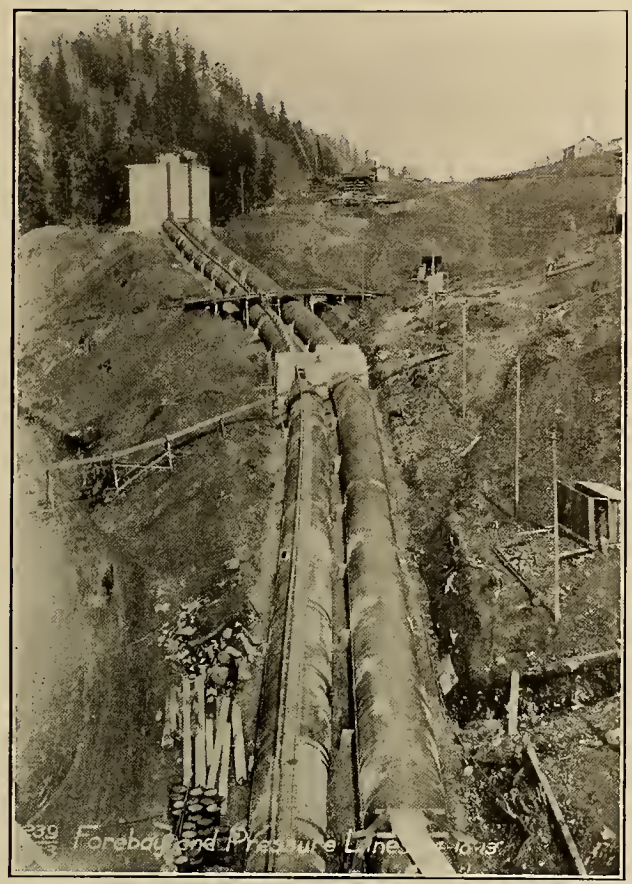
Also, a typical intermountain power stream supplying a low water flow of 2200 cu. ft. per sec. ft. Maximum flood discharge 20 times that of low water. A canon site, in rapids, with solid granite or basalt walls, 90 to 100 ft. high. Escarpment on one side, steep slope (say 60 degrees) with some talus on opposite side of river. Bench lands on both sides above walls of canon.

River at site 20 ft. deep and 70 ft. wide at low water level. Oscillation between high and low water

30 ft. Average fall of river above site for 20 miles 4.5 ft. per mile. Width of river bottom varying in width from 500 ft. to 3000 ft., with 50 per cent of same under cultivation.

Wagon road from city and adjacent farms on bench land runs within one mile of power site.

Standard gauge steam railroad 2.5 miles from site. Pacific Coast terminal rates to within 100 miles of site. Local railroad rates for 100 miles.



Forebay and Pressure Pipe Lines.

Banks of good gravel and sand within 1½ miles. Cement $2.50 per bbl. delivered by railway within 3 miles.

Timber delivered within 3 miles at $20.00 per M. b.m.; common labor $3.00; cement workers, $3.50; carpenters, mechanics and enginemen, $5.00; quarrymen, $4.00; two horse team, wagon and driver, $5.50, all for 8 hour day. This being a municipal job the preceding high wages are assumed to be fixed by municipal enactment, although on private work the wages prevail at from 9 to 17 per cent lower for a ten hour day.

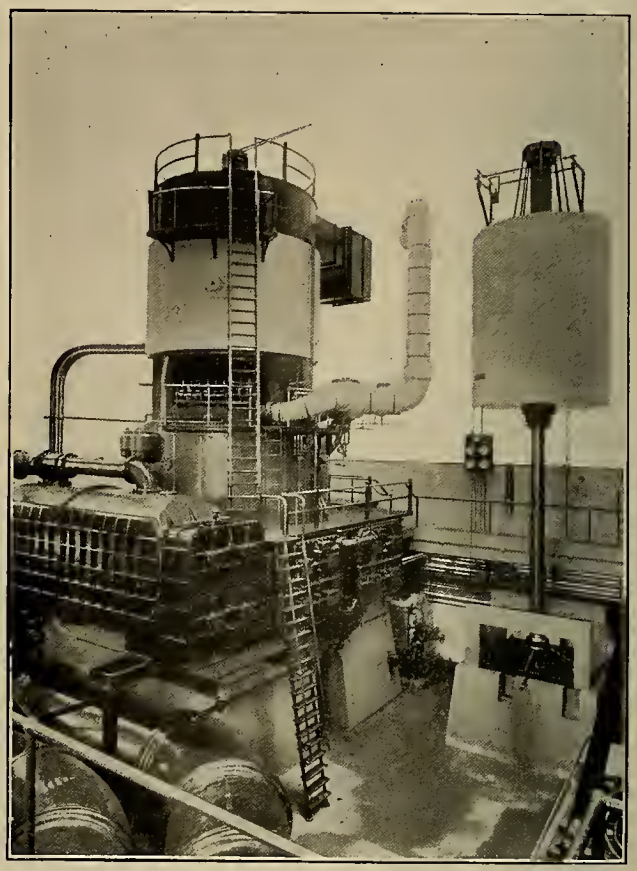
Fifty per cent of the uplands between site and city under cultivation, remainder mostly fenced, and 20 per cent of total is prime forest.

Character of present electrical market is typical of western inland cities, is already highly developed and, when viewed from a non-partisan standpoint, efficiently served.

Strong political sentiment, engendered and fostered in the customary quarters, succeeds in having the ratepayers, by a small majority vote, carry the bond issue for the installation of the municipal plant. This result has been secured even in the face of a five-fold increase in the municipal budget in the past decade.

Required: The cost of such a plant, also its operating and fixed charges, including taxes, interest on bonds, repairs and redemption fund. Depreciation must be computed by averaging the depreciation of the several elements in the plant.

Also, the probable ultimate division of the market between the proposed municipal plant and the



A Unit of the Steam Auxiliary.

present private corporation and the period in years in which the maximum load can be secured—i. e. the development period.

Population curves—growth, density, area, industrial growth, past and forecast graphs. Classes and number of services. Arc, pumping or other large special municipal services. Residence lighting, a.c. or d.c. Commercial lighting, d.c. Power, a.c. or d.c. or both, large and small runs. Rates, averages, demand, connected loads. Motor-generator set, capacity, connection and service.

Total of all classes of service in kilowatt hours, and progressive development of the same within the development period—to be set out in annual forecast statements until the end of the period is reached. These annual forecast statements must show each annual gross and net revenue in order to determine profits or deficits and the accumulation thereof. The development of the market must not conform to a straight line curve but to a sharply rising one for perhaps the first two or three years of the period, and thereafter to noticeably flatten, because of renewed activities on the part of the private service corporation and the usual awakening of the consuming pub-

lic to the efficiency of the private service, and to the inevitable inefficiency of a politically managed plant.

Also, the necessary bond issue, terms, life and probable market value. The municipality is assumed to have the legal right to incur such debt and to have favorably adjudicated such right.

Having thus briefly scheduled the assumptions and requirements, we may now proceed to an outline of the

Principal Subdivisions of the Estimate:

Cost of site by purchase or condemnation.

Cost of detailed surveys at site, of overflow rights of transmission alignment and ownership, of wagon roads, ets.

Geology—Fissures, faults, character and durability of rock, fault shattering, weathered penetration.
Outline of structural and dynamic conditions and results, of the geology.
Wagon roads, bridge, R. R. spur.
Dinky locomotives, dump cars, steam shovel.
Explosives and storage.
Also, a consideration of the economies of type, arrangement and capacity of plant, and the question of adaptability in lieu of certain of the preceding items, of a Lidgerwood cableway.

Materials of Construction—

Concrete, cement, sand, gravel or crushed stone.
Structural and reinforcing steel.
Dimension stuff, lumber.
Iron, round, strap, spikes, bolts, plate.

Coffer dams, type, dimensions, sealing, pumping, and excavation.

Stripping and foundlng and excavations, yardage and clas sification.

Diversion of river channel during construction—Method cost and resealing.

Cost of Construction Plant—

Derricks and engines and rigging, skips, etc., machine shop and wood-working plant, blacksmith shop and outfit.
Rock drilling and handling equipment.
Screens, Mixers, Bins, Elevators, Tracks, Tools, Supplies.
Temporary power—steam, air, electric. (If electric, its cost transmitted from present source with line, apparatus, etc.)
Compressor, capacity, cost, how driven, with its piping, housing, etc.
Workmen's quarters.
Water supply, tanks, piping, pumps and tanks.

Size of plant and economics of same—Main Dam, type, height, location, drainage of same, foundations, borings, excavation, sealing.

Spillway—Necessary length, surcharge, location, excavation, type and quantities.

Regulating and Retaining crest devices for holding receding waters.

Forebay and Ditch—Location, size, velocities, forebay spillway, blow-off, excavation, lining, retaining walls, trash racks or grizzlies, gates, valves, operating mechanism, its type and size.

Fish Ladder—Size, type, state requirements, etc.

Feeder pipes or penstocks—Sizes, kind, velocities, etc. (number determined by units in station.)

Tail Race—Depth, dimensions and face discharge, channel obstructions, lining and form.

Station floor elevation, in relation to high water—watertight bulkheading below that level. Distance to be determined between tail water at low water and turbine outlets, according to modern turbine practice, etc.

Generating Station—Size location, type, excavation for same.

Generating Station Equipment—

Number of units, capacity and characteristics. Capacity to be determined by assumed maximum connected loading, market demand and service.
Turbines — Type, r.p.m., regulation, dimensions, weight, feeder pipes, connections, anchorage.
Governors—Type, space and capacity.
Generators—Type, characteristics, weight, size, space, connections to turbines, exciters and their capacity, connections to generator shaft or separately driven. (If separate, include their actuating devices and equipment.)
Transformers—Size, type, location, connections, cables, oil or water supply.
Switch Board—Number of panels, type, instruments, switches, arresters, ducts, cables, wiring, switch calls and location of same.
Crane—Station supplies and machine shop with its equipment.

Overflow Rights—

Acreage, subdivisions of land and the acreage necessary to be purchased.

High Tension Transmission Line—

Steel towers, span, number of circuits. (The economics of the general question), capacities or sizes, copper vs. aluminum, length, insulators, ground wires, phone lines, right of way, voltage, power factor loss, clearing of right of way, danger, trees, easements vs. deeds.

Step Down Transformer Station—

Outdoors or housed? size or type. Location, relative to city limits or within city limits and relation to central substation.
Transformers, water or air cooled.
High tension and low tension switches.
Lightning arresters, switches, special devices, leads, insulation.
Fencing and real estate.

Low Tension Transmission Lines—

Lengths, number of circuits, voltage, pole lines, spacing, guying, right of way.
Power loss, volt drop, economics.
Size of conductors.
Length overhead.
Length underground, 3-conductor cables, ducts, manholes, trenching, etc. Manholes and sizes.
Insulators.
Routes.

Central Substation—

Economic location and real estate.
Equipment for diversified service.
Transformers, location in station and arrangement, dimensions, types.
Switchboards, sizes, types, switches, instruments and all apparatus.
Size and type of building.
(Type of apparatus largely determined by character of service of existing competitor.)
Load Factors—daily and annual.

Arc Lighting—

Number of arcs, distribution, mileage.
Transmission, overhead and underground.
General equipment.

Distribution System—

Residence lighting, meters, connections.
A.C. or D.C. Transformers, etc.
Mileage, number, location, routes, density.
Sizes of wires, duct feet, average number of conductors per duct.
(Scattered condition of western cities a serious factor in cost.)
Manholes in rock and in earth, sizes and State requirements, and equipment.
Galleries and tunnels.
Pavements and repaving and trenching.
Sub-basement depths in overcrowded underground conditions.

Steam Auxiliary—

Economic capacity, location, real estate.
Water supply, cooling surface.
Type of equipment, boilers, fuel and fuel storage and delivery—oil or coal.
Type and capacity of prime movers, size, speed, connection to generators.
Generators, size and characteristics.
Transformers, capacity, size, location, wiring, type, etc.
Switchboards, instruments, switches, synchronizers.
Size and type of building.

Summary of items with totals—

Industrial or accident insurance.
Engineering, legal and court expenses.
Contingencies.
Interest during construction.
Grand total.
Amount of bond issue, adding probable discount on bonds.

Operating Costs and Maintenance—

Power plant, attendants, oil, waste small repairs and small renewals.
High tension transmission, patrols and small repairs, ditto low tension transmission.
Step down station, repairs, attendants, oil, etc.
Distribution system, repairs, renewals, etc.
City substation, attendants, oil, renewals, etc.
Steam auxiliary, continuous stand-by help, fuel, oil, repairs and maintenance of ready to serve conditions.
Administration, accounting, quarters.
Taxes.
Interest on bonds.
Depreciation.
Total yearly expense.

Revenues—

Subdivision and classes, with rates and amounts in kw.-hr. and dollars.
Gross. Net—for development period and thereafter worked out for each year of period.
Annual profits, or
Annual deficits, for each year up to end of development period with accumulated deficits if any.

From the preceding outline it will be seen that nearly the whole technology of engineering is covered, offering, as it was designed to offer, a wide and fruitful field for discussion and investigation on the part of the student body.

An estimate of cost of such a plant following this syllabus groups itself into four broad heads each of which presupposes a wide and intimate knowledge of the respective subjects, viz: Technical, Economic, Financial, Political.

The fullness of the technologic elements is apparent, and needs no comment.

The economic questions are unusually diversified and comprehensive, beginning first with the broad question of the economy and advisability of such an investment in the face of a market which, as here assumed, is already well served, although in this instance the voters have decided that question, and so far as the engineer is concerned the question is at rest. But here is one of the fields in which the engineer seldom makes himself felt, be it said to his shame and his dereliction of citizenship duty. But further, economic studies, supplemented with technical ability, are involved throughout the whole process of making the estimate. The economic studies involved in determining the types to be adopted in the various units of the project from the best and most adaptable type of construction plant to the best strategic location of the central substation are also apparent. Furthermore, the question of day labor versus the letting of the work by contract is one of an economic character. These and kindred questions merge into the political questions of taxes, ways and means, efficiency or inefficiency of political methods and management, the functions of civic and other governmental bodies as well as the tendency now dangerously abroad in the land to destroy all forms of privately owned utility corporations. These are some of the reasons why the engineer, trained as he is and studious as he ought to be, should be the man of affairs and the leader of economic thought.

He must also know, as the preparation of the financial forecast suggests, something of the bond market and of the adverse or inviting qualities of such types of investments in a market which is already water-logged with municipal securities. He obviously cannot overlook the threatening fact that the "day of redemption" is no longer one for the divinity student to contemplate but is one which the engineer's client alone must face. The well-being of the latter is the prosperity of the former. Nor can he afford to be oblivious to the forbidding fact that the operative force, these piping days of political nostrums, is, too often, in public, semi-public or political thought, middle-class opinion. The haste with which economic questions that pertain to anything for which the public will be taxed is the result generally of this middle-class opinion. Often, too often, such questions are not corrected or checked by the best intelligence This middle-class opinion is a slave to words and catchy phrases, to specious argument, and is an instrument of utility in the hands of the self-seeking—the follower of the fatal short-cut, and is stamped with the hall-mark of political caprice. It is the mildew on the heart of progress; for it has been known to contradict the most elementary facts of economic conditions and grandiloquently to oppose all human experience.



Penstocks, Power House, Tail Race and Transmission Lines.

P. P. I. E. EXHIBIT SPACE FREE.

Intending exhibitors at the Panama-Pacific International Exposition will be much interested in the announcement made February 20, by President Charles C. Moore that the installation of exhibits may begin as early as July 1 of this year. This will enable the exhibitors to devote nine months to the preparation of their displays and will eliminate the annoyance and expense caused by the necessity of haste in preparation and installation.

The exposition is making no charge for space to exhibitors. Every effort is being made to assist the exhibitor and to reduce the expense incidental to exhibition. Arrangements have been made whereby manufacturers who need send less than carload lots may combine with other exhibitors through an accredited exposition agent and obtain the carload lot freight rate. The exhibit may be sent to a representative of the exposition at one of three central branch stations at St. Louis, New York and Chicago. The agent will assemble exhibits to obtain the carload rate and consign directly to the exposition.

A railroad has been constructed upon the exposition grounds and will pass through all of the exhibit palaces. Every facility will thus be given exhibitors in unloading and reloading exhibits. When desired exhibitors may combine so that but one attendant will be required for several exhibits.

An important announcement by the President of the P. P. I. E. follows

"We'll Be Ready."

BY CHARLES C. MOORE.

"The progress of the physical side of the Exposition work during the past year enables me to repeat with assurance the promise originally made two years ago when I said that the Panama-Pacific International Exposition would be ready when its gates opened on February 20, 1915.

"All construction work is fully up to schedule, and this schedule calls for the completion of the Exhibit Palaces by July 1, 1914. One of them, the great Machinery Palace, is practically completed now; several more will be finished in April or May and will be ready for the installation of exhibits by July 1st.

"Very active work has begun in the Concessions District on the many beautiful and elaborate structures to be erected by concessionaires to house their attractions. All these men are under rigid contract and bond to have their projects in complete working order on the opening day.

"Plans for the numerous State Buildings and for the Pavilions of foreign nations are now being submitted and approved in rapid frequency, and, whilst the Exposition itself has no direct control over the erection of these buildings, every influence that it may exert to expedite their completion will be exerted, and I apprehend no serious delays in this part of the site.

"There will be approximately 60,000 exhibits from all parts of the world installed in the main exhibit palaces. The work of selection of representative exhibits and the allotment of space will shortly be taken up and the installation of exhibits will begin about July 1st, thus giving exhibitors nearly nine months to get ready. Extraordinary care has to be taken to give exhibitors facilities for the rapid handling of their goods, and there is no reason why all the exhibits should not be completely arranged weeks before the gates are opened.

"These exhibits will make a representation of human achievement in the arts, sciences and industries which I believe has never been surpassed, or ever equalled.

"We have had over 7000 applications for concessions, and those that have been given space are on the highest plane as regards novelty, interest and attraction. Our amusement district will be pleasantly remembered for years after the Exposition closes.

"Two hundred and twelve national and international congresses have already voted to meet in San Francisco during 1915, and it is probable that the number of organized bodies which will assemble in 1915 in San Francisco will be fully 500.

"The plans for a great naval pageant are progressing well, and from assurances already received I am justified in believing that there will be few if any, nations possessing navies that will be unrepresented in the great fleet which will assemble at Hampton Roads, sail through the Panama Canal and through the Golden Gate to take part in our opening exercises.

"Detachments from the armies of many nations will gather in the Exposition grounds during 1915 and in friendly rivalry will illustrate their proficiency in feats of arms.

"The vast preliminary work of creating a great Universal Exposition is complete. The great responsibility confided by the Government of the United States to the people of California is being successfully executed.

"And as the Exposition palaces arise and the physical shell for this greatest of educative celebrations assumes that beauty in which the genius of master artists and architects conceived it, the people of America may rest assured that their pride and patriotism will find expression in a celebration that in its high educational value, in its ethical influence and in its splendor will worthily celebrate the supreme triumph of mankind in the Panama Canal."

To illuminate the cascades in the Court of Abundance at the Panama-Pacific International Exposition vapor tubes will be placed beneath the water and as vari-colored lights are produced in them, their delicate shades will glow through the falling water. Another striking illumination feature to be used in the Palace of Horticulture will make this huge palace a scene of grandeur and spendor. A battery of searchlights placed beneath the large dome of this building will project their rays through a revolving screen of various colors This will throw great shafts of colored light about the dome, illuminating the entire palace as well. The vast crystal dome of the Palace of Horticulture is 152 ft. in diameter and 186 ft. high, the greatest distance ever stretched by any similar structure of glass in the history of building construction. A plan for lighting the Court of the Sun and Stars with electric fountains also is being developed.

A REGULATION CHART FOR 50 CYCLE LINES.

BY H. B. DWIGHT.

A number of charts, more or less complicated, have been published for the determination of the electrical characteristics of transmission lines, especially the voltage and the regulation. Any chart can necessarily give only approximate results, since it is essentially a graphical solution. As the regular formulas for the approximate solution of a.c. lines, using standard tables of line constants, are not very complicated, a chart must possess distinct advantages of simplicity and rapid working in order to be useful to an electrical engineer. Keeping these requirements in mind, it is believed that the chart described herein is worthy attention, as it is easy to learn and to use, and applies to a.c. lines from a few hundred feet in length, to 100 miles.

In certain parts of the United States, notably in Southern California, the frequency of 50 cycles is used to a considerable extent, as well as the more standard frequencies of 25 and 60 cycles. The accompanying chart has been prepared for use in estimating distribution lines and transmission lines of 50 cycle systems. It is based on the similar chart for standard frequencies published by the writer in "Transmission Line Formulas" (D. Van Nostrand Co., New York, 1913.) A short description of the procedure of using the 50 cycle chart, with examples, will be given.

The necessary size of conductors for transmitting a certain load and conversely, the maximum load of a given alternating current transmission line or distribution line, are determined, in almost all practical cases, by the regulation of the line, that is, by the amount of variation in voltage due to changes in the load. For example, in many lines, the voltage at one end is kept at a constant value. Accordingly, at the other end the voltage will be normal at times of light load but will vary considerably when full load is being delivered. If this voltage variation amounts to 10 per cent or more, it is evident that the quality of service is impaired. The lowering of the voltage produces a noticeable change in the brightness of lamps, and the operation of motors is impaired by the reduction of starting torque and pull-out torque. These matters become of commercial importance at a load for which the transmission line efficiency is still high. Thus the regulation and not the cost of power for line losses is the feature on which the design of the line depends. In the majority of a.c. lines, voltage variation in some part is the chief disadvantage encountered in delivering heavy loads. The only exceptions are probably in very short distribution lines where the heating of the conductors limits the load, and in certain transmission systems where the voltage at all points is held constant, or poor regulation is partially overcome, by power factor adjustment by means of synchronous motors.

The chart described in this article is practically self-explanatory. A straight-edge is placed across the chart from the point on the left corresponding to the spacing of the conductors, to the point on the right corresponding to the resistance of one conductor per mile. The regulation factor, V, is then read directly from the chart for the power factor of load considered. This factor, V, is the change in receiver voltage per total ampere per mile of line, due to the line impedance, and from it the regulation of the line can be quickly found with a slide rule by means of the formulas on the chart. According to the usual practice, the regulation is expressed as a percentage of E, the receiver full load voltage. The regulation obtained is that of the line alone, and does not include that of transformers or protective reactance coils.

With transmission lines more than 30 or 40 miles in length, the charging current, due to the capacity of the line as an electrostatic condenser, has an appreciable effect, and produces a slightly higher receiver voltage than would otherwise be the case. Since this effect is present at both no-load and full load, it need not be considered in estimating the regulation, within the limits of accuracy and length of line given on the chart. But allowance must be made for the charging current in determining the line drop, that is, the difference in voltage between the supply end and the receiver end of a line. This is done very easily and accurately by means of the constant K, which is equal to 1.5, as shown on the chart.

The resistance points for standard conductors marked on the chart are for American Wire Gauge cables at 20 degrees C., assuming hard drawn copper of a conductivity equal to 97.3 per cent of the Annealed Copper Standard, and hard drawn aluminum of 60.86 per cent conductivity and allowing an increase of 1 per cent in resistance due to spiralling of the wires in the cable. The straight-edge may be set to any other values of resistance, and the chart is therefore applicable to all kinds of copper and aluminum conductors, except those having a steel core.

The spacing points on the chart are the same for both solid wire and cable. When the conductors of a three-phase line are not spaced at the corners of an equilateral triangle, but are at irregular distances a, b and c from each other, the effective spacing

$$s = \sqrt[3]{abc}$$

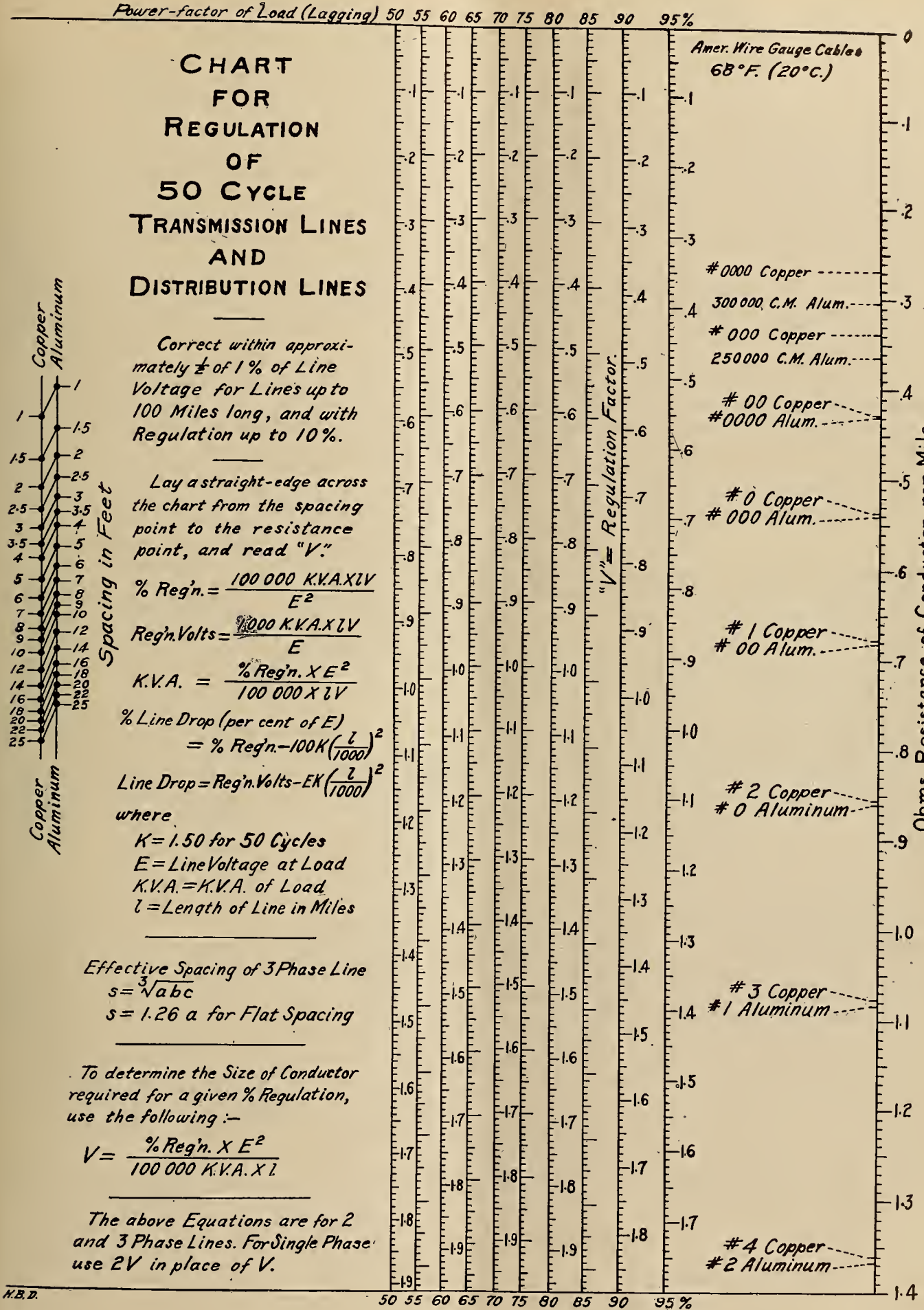
should be used. With regular flat spacing, where the middle conductor is at a distance a from the two outer ones, the equation for the effective spacing becomes simply

$$s = 1.26\,a$$

The effective spacing of a two-phase line is the mean distance between conductors of the same phase.

The problem of finding the size of conductor needed for a given load and a given regulation, is the converse to the problem discussed above, of finding the regulation of a given line. A direct solution of this converse problem cannot be obtained by any method of calculation. Hence, an important advantage of the chart is that it solves directly this very practical and useful problem. First, V is found from the formula on the chart. Then a straight-edge is placed through V and the point for the spacing to be used, and the required size of conductor can be seen, at a glance, on the resistance scale at the right.

An equation is given on the chart for solving another converse problem, namely, that of finding the k.v.a. which can be transmitted over a certain line with given regulation. Examples of the various classes of problems are added, to show the method of operation, and also the range and accuracy of the chart.


Power-factor of Load (Lagging) 50 55 60 65 70 75 80 85 90 95%
CHART FOR REGULATION OF 50 CYCLE TRANSMISSION LINES AND DISTRIBUTION LINES
Correct within approximately ½ of 1% of Line Voltage for Lines up to 100 Miles long, and with Regulation up to 10%.
Lay a straight-edge across the chart from the spacing point to the resistance point, and read "V."
% Reg'n. = 100 000 K.V.A. X l V / E²
Reg'n. Volts = 1000 K.V.A. X l V / E
K.V.A. = % Reg'n. X E² / 100 000 X l V
% Line Drop (per cent of E) = % Reg'n. − 100 K (l/1000)²
Line Drop = Reg'n. Volts − EK (l/1000)²
where
K = 1.50 for 50 Cycles
E = Line Voltage at Load
K.V.A. = K.V.A. of Load
l = Length of Line in Miles
Effective Spacing of 3 Phase Line
s = ∛abc
s = 1.26 a for Flat Spacing
To determine the Size of Conductor required for a given % Regulation, use the following :—
V = % Reg'n. X E² / 100 000 K.V.A. X l
The above Equations are for 2 and 3 Phase Lines. For Single Phase use 2V in place of V.
Copper Aluminum
Spacing in Feet
Copper Aluminum
"V" = Regulation Factor.
Amer. Wire Gauge Cables
68°F. (20°C.)
#0000 Copper
300 000 C.M. Alum.
#000 Copper
250 000 C.M. Alum.
#00 Copper
#0000 Alum.
#0 Copper
#000 Alum.
#1 Copper
#00 Alum.
#2 Copper
#0 Aluminum
#3 Copper
#1 Aluminum
#4 Copper
#2 Aluminum
Ohms Resistance of Conductor per Mile.
H.B.D.
50 55 60 65 70 75 80 85 90 95%

Problem 1.

Find, by means of the chart, the regulation and the line drop for the following case:

Length of line ..... 100 miles
Spacing ..... 8 feet
Conductor .....No. 1 alum. cable

Load, measured at receiver end, 3500 k.v.a., 66,000 volts, 85 per cent power factor, 3-phase, 50 cycles.

Lay a straight-edge from the 8-foot spacing point for aluminum conductor, to the point on the resistance scale for No. 1 aluminum cable. It is found to cross the 85 per cent P. F. line at the reading 1.275. Then, by the formula on the chart,

$$\text{Per Cent Regulation} = \frac{100{,}000 \times 3500 \times 100 \times 1.275}{66{,}000 \times 66{,}000}$$

$$= 10.2 \text{ per cent.}$$

The regulation, calculated according to the standard hyperbolic transmission line theory, is 10.37 per cent, and so the error involved in using the chart is less than 1/5 of 1 per cent of line voltage.

The per cent line drop, according to the chart, is

$$10.2 - 100 \times 1.50 \times \frac{1}{100} = 8.7 \text{ per cent.}$$

The calculated line drop is 8.76 per cent and therefore the error in using the chart is less than 1/10 of 1 per cent of line voltage.

Problem 2.

Find the size of copper required to give approximately 8 per cent voltage drop in the following case:

Length of line ..... 12 miles

Regular flat spacing, wires 4 ft. apart

Load, measured at receiver end, 750 k.v.a., 70 per cent power factor, 11,000 volts, two-phase, 50 cycles.

First, find V from the formula on the chart.

$$V = \frac{8 \times 11{,}000 \times 11{,}000}{100{,}000 \times 750 \times 12}$$

$$= 1.075$$

The effective spacing is 1.26×4, or 5.04 ft. The proper spacing point will therefore be just below the spacing point for 5 ft., copper conductor. Lay a straight-edge from this point to the reading 1.075 on the line for 70 per cent P. F., and it is found to cut the resistance scale at 0.88 ohms per mile. The nearest size of copper is seen to be No. 2.

Problem 3.

Find the k.v.a. which can be delivered by the following single-phase line with 10 per cent regulation:

Length of line ..... 2 miles
Spacing ..... 1½ ft.
Conductor .....No. 0 copper wire

Character of load (measured at receiver end), 2200 volts, 90 per cent P. F., single-phase, 50 cycles.

From the chart, V = 0.70.

Then, using 2 V because the line is single-phase.

$$\text{K.v.a.} = \frac{10 \times 2200 \times 2200}{100{,}000 \times 2 \times 2 \times 0.70}$$

$$= 173 \text{ k.v.a}$$

ELECTRIC RAILWAY STATISTICS.

Preliminary figures of the forthcoming quinquennial report on the electric railways of the state of California have been given out by Director W. J. Harris of the Bureau of the Census, Department of Commerce.

The statistics relate to the years ending December 31 for 1912 and 1907, and June 30 for 1902. The totals include electric light plants operated in connection with electric railways and not separable therefrom, but do not include reports of mixed steam and electric railroads nor railways under construction during the census year which had not begun operations.

The figures presented for California show general gains in the industry during the decade 1902-1912. The number of electric railway companies in the state increased from 35 in1902 to 44 in 1912, a gain of 26 per cent. The gross income amounted to $34,845,771 in 1912 as compared with $9,967,838 in 1902, an increase of 250 per cent. The revenue passengers carried numbered 520,741,159. in 1912 as compared with 182,196,999 in 1902, an increase of 186 per cent. The miles of track increased from 829 in 1902 to 2606 in 1912, a gain of 214 per cent. The number of persons employed were 16,749 in 1912 as compared with 5442 in 1902, an increase of 208 per cent. The total horsepower increased from 38,085 in 1902 to 48,311 in 1912, or 27 per cent, but the bulk of the power consumed by the electric railways was purchased as current, 481,625,400 kilowatt hours of purchased current being reported in 1912. The figures in detail are shown in the accompanying table:

California.

	1912.	1907	1902	Percent of increase:[1] 1902-1912.
Number of companies..	44	42	35	25.7
Operating	35	41	35	....
Lessor	9	1	....	....
Miles of line	1,766.20	1,264.10	551.40	220.3
Miles of single track ..	2,606.40	2,013.49	829.10	214.4
Cars, number	4,652	3,760	2,056	126.3
Passenger	2,791	2,406	1,850	50.9
All other	1,861	1,354	206	803.4
Electric locomotives ...	49	15	....	....
Persons employed	16,749	11,466	5,442	207.8
Salaries employees.	1,784	904	255	585.5
Wage earners (average number) ...	[2] 15,001	10,562	5,187	189.2
Power:				
Horsepower, total..	48,311	60,655	38,085	26.8
Steam and gas engines (including turbines):				
Number	46	52	74	—37.8
Horsepower ..	48,046	60,455	31,590	52.1
Water wheels:				
Number	3	2	8	—62.5
Horsepower ..	265	200	6,495	—59.2
Kw. capacity of dynamos	30,817	44,400	22,897	34.6
Output of stations kw.-hr.	11,274,069	111,870,849	44,676,030	—74.8
Current purchased, kw.-hr.	481,625,400	[3],	[3]	.....
Passengers carried	683,326,934	441,895,205	241,325,720	183.2
Revenue	520,741,159	327,977,151	182,196,999	185.8
Transfer	150,298,412	109,230,255	55,128,721	154.2
Free	12,287,363	4,687,799	[3]	.....
Car mileage (passenger, express, freight, etc.)	116,553,876	74,785,472	41,512,788	180.8
Condensed income account of operating companies:				
Gross income[4]	$34,845,771	$21,545,797	$9,967,838	249.6
Operating expenses.	$21,684,312	$14,578,367	$5,402,245	301.4
Gross income less operating expenses	$13,161,459	$6,967,430	$4,565,593	188.3
Deductions from income (taxes, fixed charges, and miscellaneous)	$10,696,969	$6,732,705	$2,112,959	406.3
Net income	$2,464,490	$234,725	$2,452,634	0.5

[1] A minus sign (—) denotes decrease.
[2] Number employed Sept. 16, 1912.
[3] Figures not available.
[4] Income from sale of electric current included in 1912, $75,817; 1907, $366,566; and 1902, $279,216.

CENSUS FIGURES ON ELECTRIC LIGHT AND POWER.

Preliminary figures of the forthcoming quinquennial report on the central electric light and power stations of the state of Oregon have been given out by Director W. J. Harris, of the Bureau of the Census, Department of Commerce. They were prepared under the supervision of W. M. Steuart, chief statistician for manufactures.

The statistics relate to the years ending December 31 for 1912 and 1907, and June 30 for 1902, and cover both commercial and municipal electric plants. They do not include electric plants operated by factories, hotels, etc., which consume the current generated, those operated by the Federal Government and state institutions, or plants that were idle or in course of construction.

The figures as presented for Oregon show that during the decade 1902-1912 there were substantial gains. The number of establishments in 1912 was 66 as compared with 39 in 1902, or an increase of 69 per cent. The total income in 1912 amounted to $1,406,144 as compared with $691,582 in 1902, or an increase of 103 per cent. The total expenses amounted to $1,205,738 in 1912 as compared with $499,632 in 1902, or an increase of 141 per cent. The total horsepower of engines amounted to 16,213 in 1912 as compared with 6,603 in 1902, or an increase of 146 per cent. The total horsepower of the water wheels increased from 11,195 in 1902 to 29,802 in 1912, or 166 per cent. The output of stations was 58,789,342 kilowatt hours in 1912 as compared with 17,531,660 in 1902, or an increase of 235 per cent. The estimated number of arc lamps wired for service showed a decrease in 1912 as compared with 1902, numbering 1285 for the former year and 2023 for the latter, or a decrease of 37 per cent. All other varieties of lamps, however, increased from 95,045 in 1902 to 382,196 in 1912, or 302 per cent.

The figures are shown in detail in the accompanying table:

Oregon.	1912.	1907.	1902.	Per cent of Increase:[1] 1902-1912.
Number of establishments.	66	61	39	69.2
Commercial	54	50	33	63.6
Municipal	12	11	6	100.0
Income	$1,406,144	$1,965,245	$691,582	103.3
Light, heat and power	$1,364,226	$1,840,155	$638,571	113.6
All other sources	$41,918	$125,090	$53,011	—20.9
Total expenses, including salaries and wages	$1,205,738	$1,283,560	$499,632	141.3
Total number of persons employed	532	467	187	184.5
Total horsepower	46,015	126,815	17,798	158.5
Steam and gas engines (including turbines):				
Number	63	65	37	70.3
Horsepower	16,213	24,259	6,583	146.3
Water wheels:				
Number	60	72	46	30.4
Horsepower	29,802	102,052	11,195	166.2
Auxiliary engines:				
Number	[2]	7	2	.....
Horsepower	[2]	504	20	.....
Kw. capacity of dynamos.	32,416	32,587	11,165	190.3
Output of stations, kw.-hr.	58,789,342	92,807,992	17,531,660	235.3
Estimated number of lamps wired for service:				
Arc	1,285	[3] 3,927	2,023	—36.5
All other varieties	382,196	[3] 372,844	95,045	302.1
Stationary motors served:				
Number	1,527	2,072	403	278.9
Horsepower capacity	15,843	20,452	4,020	294.1

[1] A minus sign (—) denotes decrease.

[2] Not reported separately.

[3] Exclusive of 31 arc and 2,516 lamps of other varieties reported by the electric companies as used to light their own properties. Lamps used for such service were included in the number reported for 1912.

OUTDOOR INDIRECT LIGHTING.

A system of lighting never before utilized in expositions—for the reason that the mechanism making it possible has never before been perfected, will maintain, at night, the chief zone of illumination throughout the 625 acres of the grounds of the Panama-Pacific International Exposition to a height of 125 ft., with a variation of but five per cent throughout this height.

This light will for the most part be created by nitrogen filled lamps similar in form and principle to the ordinary incandescent lamp, save that here the metal filament burns not in a partial vacuum, but in an atmosphere of nitrogen gas. The light of this lamp is intense and one the size of an ordinary 32 candlepower bulb, will give 2500 candlepower. The lamps will be ranged up and down standards of from ten to thirty feet in height, and the eye of the observer will be shielded from the powerful direct rays by metal banners. In fact, all the lighting of the exposition palaces and grounds will be by the indirect "flooding" system, from concealed sources. The main advantage of this system over the old outline plan of using electric bulbs along the architectural lines of buildings, as at previous expostions, is that it permits the beauty of perspective and shadows to be preserved.

Realizing that the old outline system, with all its crudities and faults, had certain merits, the exposition engineers and architects have substituted polished jewels of hardest glass, with which the architectural lines and ornamentation upon the palaces will be emphasized. These jewels are of various colors, cut like huge rose diamonds, and are hung upon pendants so that they tremble constantly with the natural vibration of the palaces, while the least breath of breeze has the effect of causing them to flame into life, and the walls of the palaces to glow with multicolored fire, like live coals which have been blown open.

The searchlight scintillator, which in a modified form, was experimented with during the Hudson-Fulton celebration, will be used in its perfected form, from a tower upon an outjutting point enclosing the yacht harbor. A battery, the most powerful ever seen in this country, composed of forty-eight 36-in. searchlight projectors, will throw intense rays of light through color diffusers, which will separate the flood into fan shaped rays of all colors of the spectrum. These rays will be thrown upon the jeweled walls of the palaces, and upon the gardens and courts, and will play upon the beautiful white fog banks which often at twilight roll in through the Golden Gate.

In order to enhance the sense of magic, the builders of the exposition have forbidden the use of clocks architecturally, even in the amusement concessions, that the count of time with the pressure of everyday ideas and duties may not intrude upon the visitor. There shall be "no time"—"neither night nor day"—at the exposition.

Electric light and power meters rejected in Western Canada under government inspection during the year ending March 31, 1913, amounted to the small total of but twenty-two out of 28,780 meters inspected.

LIGHTING METHODS

PLANNING LIGHTING INSTALLATIONS.

BY J. B. JACKSON.

(The author, who presented this paper before a recent joint meeting of the Illuminating Engineering Society and the Chicago Architects' Business Association, gives a simple method of calculating illumination which, though approximate, will be valuable as applicable to the majority of lighting installations.—The Editors.)

It has not been uncommon in the past that provisions have been made for a certain number of outlets for an interior and the actual design of lighting equipment left until the building is practically completed. Very little consideration has been given in a great many instances to the factors which influence illumination results. This imposes conditions which are later very hard to meet, and the design usually becomes a matter of compromise. To obtain definite predetermined results it is necessary to know in advance the general scheme of decoration and the type of lighting equipment desired, and provision must be made for its correct use.

Methods of planning lighting installations have been the result of gradual evolution of the use of different illuminants and the introduction of new light units of higher illuminating value and in general have scarcely kept abreast of recent developments. The high power gas and the tungsten incandescent units require somewhat different treatment than did the open flame burner and the carbon incandescent units.

With the information now available it is possible to successfully apply engineering principles to the design of lighting installations and obtain results which are satisfactory in every respect. It is essential in considerations of light sources to have a clear conception of light as a quantity. Every lighting unit is capable of being evaluated in terms of a standard. It is unfortunate that the term candlepower has received such wide application. This would not be such a serious condition were it not for the fact that every unit has been referred to in terms of its maximum candlepower and has as a consequence given rise to some very erroneous conclusions.

If we consider a light source suspended in the center of a sphere in such a manner that all the light is intercepted by the interior surface and make use of some method of either measuring or calculating the light inclosed within the sphere, we then have a direct means of comparison of one light source with another. It is evident then that if light sources are expressed in terms of their average candlepower (otherwise called mean spherical candlepower) we may then make comparisons since the last quantity always bears a definite relation to the total flux of light.

A standard unit of luminous flux has been chosen which is designated the lumen, which for the purpose of this paper need only be defined as a measurable quantity of light, equal to 12.57 times the mean spherical candlepower. Table I is an evaluation of the different kinds of incandescent electric lamps which have been used or are in use at the present time. The first column gives the common designation as to kind of filament or some common characteristic which has been associated with the lamp. The second gives the nominal candlepower (in case of the incandescent units being in the horizontal direction). The tungsten or Mazda units have usually been expressed in terms of watts consumed, hence their horizontal candlepower values are not so commonly known. The third gives the energy consumption expressed in watts. The fourth column contains the value of the lamps in terms of light units (lumens) as referred to above and may be taken as a measure of the illuminating value. The last column contains a multiplying factor to be used as will be explained later. In the consideration of this table it should be remembered that these values apply to the quantity of light given off by the lamp unequipped with reflector, globe or other accessory.

Table 1—Lamp Values.

Kinds of Filament.	Horizontal or Nominal C.P.	Watts.	Light Units. (Lumens)	Multiplying Factor.
Carbon	2	10	21	4.95
Carbon	4	20	50	3.84
Carbon	8	30	96	3.02
Candelabra Carbon	8	31.1	96	3.10
Gem	20	50	207	2.31
Gem	32	80	337	2.28
Tungsten	7.7	10	76	1.26
(Mazda)	12.0	15	118	1.22
(Mazda)	17.1	20	168	1.14
(Mazda)	21.9	25	215	1.12
(Mazda)	36.4	40	357	1.08
(Mazda)	56.0	60	549	1.05
(Mazda)	98.0	100	960	1.00
(Mazda)	167.0	150	1637	.883
(Mazda)	278.0	250	2722	.882
(Mazda)	445.0	400	4535	.847
(Mazda)	556.0	500	5665	.847

The next question which naturally arises is how are we to determine the amount of light on any surface, also how are we to obtain a measure of the light required for certain classes of service. If we can imagine that light is radiated from a source in the form of rays and let some surface intercept a portion of these rays, it is evident that the number of rays which fall on a unit area represents a measure of the flux density or the density of the light rays upon the surface. If a standard be chosen which will represent a certain flux density then it is possible to measure by means of photometric apparatus any flux value in terms of this standard. This standard representing also the number of lumens per sq. ft. impinging on the illuminated surface, has been given the name foot candle. It should be considered as being only a measure of the density or intensity of the illumination produced.

Suppose an observer place himself in a position before a desk with a printed sheet of standard size type and we vary the illumination upon this sheet and when the illumination has reached a value which satisfies the observer a measurement is taken. By taking a series of these readings and obtaining an average value it is possible to state that for that observer the intensity value obtained may be considered as satisfactory for that class of service. These values vary in different observers, as one authority (Cravath) has stated, as much as 5 to 1. The following table gives the values in foot candles for different

classes of services and have been obtained by following methods similar to that above described. An average value has been obtained in some installation which has been classed as satisfactory.

It has often been stated that one system of lighting requires less intensity than another but there is not sufficient authoritative data along this line to warrant any such assertion. Regarding the most recent tests, the U. S. Postal Car Specifications contains the requirement that the illumination shall be not less that 2.8 foot candles, in parts of a car used for reading letter addresses, this value being comparable to the requirements for desk and office purposes. There seems to be considerable tendency toward requiring more and more light. In other words, our standards are raising gradually, probably not due to any changes in the human eye but more likely because illumination is now readily and cheaply obtained.

It will be noted that the values given in the table are in ranges, such as 2 to 4 ft. candles; being given in this manner to allow some opportunity for the designer to make a choice according to his knowledge of the actual service required. Values given in the table are an average for the entire room.

Table 2—Foot Candle Intensities Recommended for Various Classes of Service.

General—	
Armory	2.0
Art Gallery (Walls)	5.0—10.0
Auditorium	1.0— 3.0
Automobile Showroom	3.0— 6.0
Bank (General)	2.0— 3.0
Bank (Desks)	4.0— 6.0
Billiard Room (General)	.8— 1.5
Billiard Table	6.0—10.0
Cafe (General Only)	2.0— 4.0
Cafe (With table lights)	1.0— 2.0
Card Room (Tables)	2.0— 3.0
Church	1.0— 2.5
Drafting Room	6.0—12.0
Desk	4.0— 6.0
Engraving	10.0—12.0
Factory (General Only)	.8— 1.5
Local Bench (Fine Work)	5.0—10.0
Local Bench (Coarse Work)	3.0— 5.0
Gymnasium	1.0— 3.0
Hotel—	
Bedroom	1.5— 2.0
Corridor	.6—
Dining Room (General)	2.0— 4.0
Dining Room (Lights on Tables)	1.0— 2.0
Lobby	2.0— 4.0
Library—	
Stock Room	1.6— 2.0
Reading Room (General)	3.0— 4.0
Reading Room (With Local)	.7— 1.5
Offices—	
Small Office (Private)	3.0— 6.0
Small Office (General Use)	3.0— 5.0
Large Office (General Illumination)	3.5— 5.0
Large Office (With Desk Lights)	1.5— 2.0
Residences—	
Hall	.7— 1.0
Parlor	1.0— 3.0
Living Room	1.5— 2.5
Library	1.5— 2.5
Dining Room	1.0— 3.0
Kitchen	2.0— 3.0
Laundry	1.5— 2.0
Bedroom	1.0— 3.0
Bathroom	2.0— 3.0
Store & Furnace Rooms	.4— .8
Stores—	
Clothing	4.0— 7.0
Dry Goods	4.0— 7.0
Furniture	2.0— 4.0
Grocery	2.0— 4.0
Hardware	2.0— 4.0
Jewelry	4.0— 6.0
Millinery	4.0— 6.0
Shoes	2.0— 4.0
Stationery	2.0— 4.0
Warehouse	.5— 1.0

There are two classifications of fixtures in general use at the present time, namely ceiling and bracket. Of these the ceiling fixture is much more efficient as a lighting unit. With the spacing of ceiling outlets placed in the center of approximate squares we approach the nearest to the condition of uniform illumination which for most purposes is considered to be ideal. The use of bracket fixtures for general illumination is not to be recommended and should be used only when some consideration is given to special or decorative features. In commercial work, it is safe to state that the bracket fixture has very limited application. The fixtures of this type have often been installed and the reason for doing so advanced that they can be used for connection for fans, portable lamps, etc. This is not to be encouraged as baseboard and floor receptacles make a much more convenient and sightly connection and as a general rule at a cheaper installation cost. If sufficient capacity were installed for bracket fixtures for general illumination the center of the room would be darker than near the walls. Under these conditions objectionable glare is almost always introduced as the usual bracket is much too low for use under these conditions.

Table 3—Desirable Sizes of Squares.

Kind of Room.	Ceiling Height. ft.	Desirable length of Side of Square. ft.
Armories	12—16	12—16
Auditoriums	12—16	12—16
Public Halls	over 16	15—26
Rinks	over 16	15—26
Stores	8—11	8—11
Stores	11—15	10—16
Stores	over 15	14—22
Offices with desk lamps	10—20	12—18
Offices without desk lamps	9—12	7—11
Offices without desk lamps	12—16	9—14
Offices without desk lamps	over 16	11—18

As stated above the most even distribution of light is obtained by the use of ceiling units spaced in the center of squares or rectangles approaching square. The size of these squares are determined by features of the space to be illuminated, such as dimensions of bays and ceiling height. Table 3, given below, shows desirable sizes of squares for location of ceiling outlets under different ceiling heights and for different classes of buildings.

[To be continued.]

INSTALLATION OF HIGHER EFFICIENCY MAZDA LAMPS.

As the new higher efficiency Mazda incandescent lamps have now been developed for commercial purposes and the 1913 Edition of The National Electrical Code does not contain rules to govern, completely, installation of such units, the Underwriters' Equitable Rating Bureau, Portland, Oregon, has furnished special rules to govern the installation of these units.

Doubtless at the next meeting of the Electrical Committee of the National Fire Protection Association, new rules will be formulated to apply to the installation of these new units.

Until further advised the Bureau will expect the following requirements to be carried out in all cases where the new higher efficiency Mazda incandescent lamps are installed on old or new electrical installations:

(1) Each unit must be placed on a separate two-wire circuit.

(2) Each wire of the two-wire circuit must have the following capacity: a—No. 14 B. & S. gage rubber covered wire, or equivalent current rating in other installations, for the 750 watt, 100-120 volt unit; b—No. 12 B. & S. gage rubber covered wire, or equivalent current rating in other insulations for the 1000 watt, 100-130 volt unit.

(3) Each two-wire circuit must be protected by a two-pole cutout of not more than 10 ampere capacity for the 750 watt unit and not more than 12 ampere capacity for the 1000 watt unit; a—"Mogul Base" sockets or receptacles rated for 660 watts or more must be used with these units. See Rule 72, National Electrical Code—Sockets—under which we will accept any "Mogul Base" socket or receptacle, which is at present rated at 660 watts and has been approved by the Underwriters' Laboratories, Inc., if used in connection with the above units.

(4) Fixtures—When fixtures are installed with these units, properly designed fixture must be chosen which will safely radiate the heat which is developed by them.

EFFECT OF FORESTS ON RUN OFF.

BY J. C. STEVENS.

(Continued.)

We are able to present some very interesting data on the frequency and height of moderate floods of Merrimac River, in addition to those of maximum heights given in the foregoing table. To do this rationally, it is first necessary to define what constitutes a flood. The commonly accepted definition of a flood in such a rise in a river that lands not usually covered are overflowed. Usually a "danger line" is fixed, above which damage is likely to occur. Obviously such a danger line is purely arbitrary, and usually the developments on the banks of the stream are the governing factor. In an uninhabited country there would be no danger line. However, it is necessary to fix such a limit above which the river would be called "in flood" and below which the river would be normal or in moderate freshet. On the Merrimac River the gauge height of 15 ft. has been fixed as a danger line. I quote from Col. Burr's report, p. 24:

* * * it was determined to class as floods only such rises as reached or exceeded a height of 15 ft. on the gauge and to consider such a rise as constituting only one flood between the times it passed 8 ft. on the gauge in rising and again in falling. In computing flood duration and discharge, consideration was given only to the period during which the river was above gauge 10 ft. These arbitrary limits were assumed after a thorough study of the hydrograph for the entire record and are believed to provide a fair basis for the analysis of flood characteristics. The effects that might result from the use of other similar limits are unknown, since no others have been tried, but there is no reason to expect that any other set of standards, selected within rational limits and without regard to results would lead to conclusions of a different character.

The following table gives the essential facts adduced in Col. Burr's analyses:

Floods on Merrimac River.

Period.	Number of floods (above 15 ft. on gauge)	Number of days per year floods were above 10 ft. on gauge.	Average annual runoff during floods (in.)	Percentage of flood to annual runoff.
1st 9 years— 1850-1858..	22	65.1	10.33	42
2d 10 years— 1859-1868..	14	61.2	9.63	41
3d ten years— 1869-1878..	16	62.8	10.20	44
4th 10 years— 1879-1888..	13	54.1	8.32	38
5th 10 years— 1889-1898..	13	49.2	7.49	34
6th 10 years— 1899-1908..	15	56.2	9.24	42

The last column in the above table gives the average proportion of each year's yield that ran off as flood discharge. If the forestry theory is correct, we should see a progressive decrease in this percentage since the forest area on the watershed has increased, but the table shows the same percentage during the last period as obtained in the first, yet the forest area was 30 per cent greater.

There appears to be a period from 1850 to 1860 when floods were more severe than in later years. There also appears an increase in flood severity coincident with reforestation. Floods are always produced by peculiar and erratic climatic combinations and the slightly higher frequency in the first, third and last periods is due solely to such combinations and not in any degree to forest confluences.

I quote below the conclusions at which Col. Burr arrives in his report, page 31:

Deforestation of the basin continued progressively from the early settlements until about 1860-1870, and since that period forested areas have increased through natural causes by 25 per cent or more of the entire basin, notwithstanding the continuance of lumbering operations.

There has been no decrease in precipitation in the basin as a result of deforestation or any increase with the reforestation of 25 per cent or more of its area. The precipitation for 50 to 90 years at points within the basin or within a few miles of its borders shows tendencies or cycles that bear no relation to the changes in forest areas.

The average runoff through the river varies with the precipitation over its basin, and the percentage of runoff to precipitation is not appreciably affected by forest changes as great as 25 per cent or more of the basin.

The frequency of floods has not been decreased by reforestation or increased by deforestation.

Exceptionally high floods have occurred at intervals without respect to forest conditions. Flood heights have not been decreased by forestation or increased by deforestation, and the principal characteristics of floods are unaffected by forest changes. The duration of flood stages and the amount of runoff during such stages have not been affected adversely by deforestation or beneficially by reforestation.

Deforestation has not lessened the height of the river at low water or increased the duration of low-water periods, and the reforestation of 25 per cent or more of the basin has not had any beneficial effect on low stages of the river.

Variations in stream flow are determined essentially by variations in climatic conditions which move in irregular cycles independent of forest changes.

Periodic Variations.

A study of the foregoing records of long standing will reveal a tendency towards periodic variations. It is well known that wet and dry years occur in groups. Although an extremely wet year may succeed an extremely dry one, or vice versa, the tendency toward cycle or secular variations is very evident. This phenomena has an important bearing on the question of forests and water supply, chiefly because facts and data are often arrayed against the memory of the oldest inhabitant to establish or refute a theory of this nature.

It is an almost universal belief that the climate is changing; that floods, rainfall, temperatures, etc., are all "different than they used to be." No matter where one goes, the same statement is heard. It is a perfectly natural conclusion and results from two causes, one psychological, the other physical. As we grow older, our perspective undergoes an adjustment. We only retain impressions of those things that are associated in our memory with particular circumstances. "Man marks when he hits, but never marks when he misses." We recall wading snowdrifts to school. Today those snowdrifts do not seem so deep and we immediately conclude that they are not. The water in the "old swimming hole" was much deeper when we were boys; today it is only waist-deep and we think the river is smaller than it used to be. We visit a spring, after a lapse of years, from which we drank when boys; it doesn't seem so large nor the water so fine as then. The spring is the same, but

our conception of it has changed. Our memory of it is fixed by some isolated circumstance connected with it, while today we view it in the abstract, unconsciously comparing it with others we have seen since. A man's memory of high and low stages of rivers alongside of which he has always lived, is invariably governed by isolated circumstances and incidents which he does not remember consecutively. For this reason such evidence is always untrustworthy, and only those who have had occasion to gather evidences of this kind know how conflicting and untrustworthy they are.

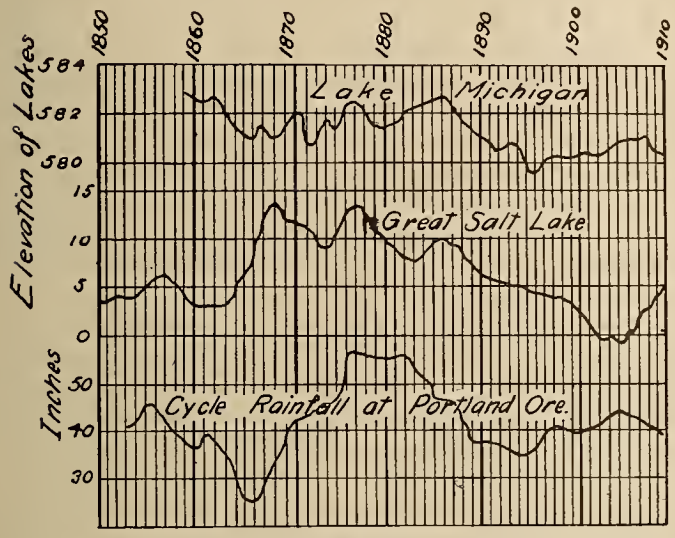


Fig. 5. Chart Showing Secular Variations in Physical Phenomena.

The second and principal reason for the universal belief that physical phenomena are changing is that they are actually undergoing continued changes, not, however, to the degree nor in the manner that is popularly believed. Rainfall, temperatures, humidity, winds, and consequently the stages of rivers and lakes, occur and recur with variable length and intensity. The major cycles are longer than the life of an average man—at least longer than his faculty for accurate recollection. Yet it is largely on such memories and on such data that the forestry and similar theories are frequently based. For this reason it is well to inquire briefly into the matter.

In order to show the secular variations in physical phenomena. I have prepared a diagram, Fig. 5, which is a graphical representation of the changes in water level of lake Michigan and of Great Salt Lake, Utah. These large bodies of water rise and fall with the major variations in runoff, evaporation, etc. They do not reflect minor variations, and therefore possess an averaging influence on these physical phenomena.

Great Salt Lake steadily fell from 1868 to 1905, and the general impression there is that the lake is drying up. But it was probably lower in the forties than in 1905. Since the latter date it has steadily risen. In order to show that these variations do conform to the cyclic changes in precipitation, I have shown the cycle rainfall (5 year averages) for Portland, Oregon. The water supply for Utah comes from the Pacific Ocean, and the Portland records or any other good record in the path of the vapor bearing winds, will indicate the yearly variations.

These two curves are approximately parallel, and show in a striking manner how closely related are the major climatic cycles and how broad their zone of influence. The changes in level of Lake Michigan and in precipitation on the Atlantic Coast, show a general correlation with those of precipitation and lake levels on the Pacific Coast. The causes of these variations are beyond the scope of man's endeavor. The mere cutting or planting of trees, tilling of land, or anything that man undertakes, will not nullify or modify the physical laws that govern these phenomena; his influence is limited to the uppermost film of the earth's crust. His greatest effort can scarcely effect material changes even there, and certainly cannot reach into the realms of earth and sky wherein originate the mighty forces that affect these phenomena.

From a study of the foregoing diagrams it is easy to see how one's impressions of the changes in climate will depend altogether upon the length and vividness of his memory.

These secular changes explain some of the progressive tendencies noticed in the runoff from the rivers heretofore cited. Thus the rainfall and runoff on Tennessee River appears to have persistently decreased since the beginning of the record in 1875, a period of generally high rainfall. If the record extended back 30 years farther, it would tell a different story. The Ohio record shows the same tendency, rising from 1860 to 1880 and gradually falling since. The precipitation record extends back much further and shows the same general tendency as seen in the New England record. The runoff would follow the same law if the record was of sufficient length.

(To be continued.)

Land telegraph systems in the United States numbered twenty-two, as of December 31, 1912, and these operated 247,528 miles of pole line, according to statistics just given out by the Bureau of the Census. One hundred three million, five hundred thirty-six thousand four hundred eighteen messages were transmitted, for which $56,293,469 was paid. The systems were at that time capitalized at $104,274,435 and the net earnings for the year amounted to $3,431,044. The employes number 35,639 and their wages were $23,797,980.

The new electrically driven collier Jupiter has scored a signal success on her trial trip, just completed off the Lower California coast. Though rated as a 14-knot boat, she maintained an average speed of 15.1 knots for forty-eight hours, her electrical machinery developing 5940 h.p. Electric propulsion is being tried by the Navy for the first time on the Jupiter, and the department officials are pleased with the result. The collier was in competition with the collier Neptune, fitted with a reduction gear on her turbines, designed to effect economy, and the Cyclops, fitted with reciprocating engines. All three vessels were of the same size and of similar lines, and the excellent performance of the Jupiter may have an important effect on future naval construction.

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Aiming to Aid

Heretofore bills introduced in connection with water power development have aimed to control development, and the resultant Government control has been so complete that stoppage of development has more nearly resulted. Statistics show that development has taken place, but it has been a harassed hazard, occurring to fill a compelling public need.

It is, therefore, of interest to note that the object of the bill introduced in the Senate by Mr. Jones on February 7, 1914, is to aid and to regulate the development of water power on United States lands.

This bill provides for a fifty-year occupancy of public lands for the purpose of water power development, at an annual rental of five per cent of its fair market value, by any State, municipality, or corporation, whose maps and plans satisfy the Secretary of the department having jurisdiction "that the proposed development will promote the highest and greatest practicable use of the water resources involved."

In rate making the rental is to be considered an operating charge, but the land is to have no capitalization value. The United States reserves the ultimate right to regulate all rates. At the end of the period of tenure, Congress may provide for the taking over of the properties at a fair value by the Federal or State Government, or by a municipality. All such values are subject to Court determination. Development of as much power as the market can absorb must be started within two years, and finished within five years. Water power is to be the dominant use, and this reservation is to be expressed in all patents issued for such land.

Is is also provided—for the ghost of that water power monopoly will not down—that works so constructed shall not be owned or leased by a monopoly or used in restraint of trade.

The law is retroactive, as it is provided that the rights to be granted will upon application, inure for the benefit of existing projects.

At first flush, this bill appears keyed right up to the highest point of utilization, and to promise fulfillment of President Wilson's policy of "a wise use," to represent the acme of simplicity, and to favor prompt and complete development.

The certain tenure stated, although not for so long a period as might be desired, should remove an objectionable feature which now exists, thus enabling capital for water power development to be more readily secured. It endeavors also to protect the developer against the appropriation of the land he now occupies by any claimant under public land laws, now possible merely on the ground of a claim initiated subsequent to the time the land was occupied for water power purposes.

As far as can be seen at present, the only combination, perhaps an unintentional conspiracy to limit the output of electric energy, is rate regulation which allows only a reasonable rate of return upon investment without reference to the standard of service rendered by the utility.

It will soon be appreciated that the public will be best served by this factor being taken into consideration. Utilization of investment and not investment alone should measure the rate of return.

These comments are gratuitous and of course previous, seeing that the bill is not yet law, but they are certainly pertinent to a full discussion of this measure, which leans toward complete development, and apparently aims to aid.

Efficiency and the Individual

What is time? What its relationship to the power which actuates—achieves? The age of Methuselah is not a prospect of those who live in the present, but can it be said that they accomplish less? Time, though necessary to accomplishment is but incidental.

Getting equal results with the lapse of less time than heretofore, or better results in the same time, constitutes efficiency. But efficiency is not time. Efficiency is the power that accomplishes.

An efficient individual is one with active interest plus adequate knowledge and skill for the performance of the thing to be accomplished.

Incentive to utmost endeavor should not depend upon the bare necessity for accomplishing certain tasks according to schedule, but upon the very love of accomplishment.

Man has that in his headpiece which is more exact, or at least more exacting, than any timepiece. That which imperatively commands him to do that which is right, and to abstain from the wrong.

Great work, art for example, is but the expression of man's joy in what he does.

If you contemplate accomplishment merely because of lapse of time, you will be disappointed. Accomplishment consists in both having and exercising the power to get results.

In getting that knowledge and in its application, there are certain principles of efficiency—certain fundamental causes that tend to naturally produce better results—which it is advantageous for the individual to know and use.

But if standards are adopted they should be elastic, for progress and improvement cause changes which must be conformed to. The efficient individual does not act with reference to the past, but recognizing the practical requirements of the present, interprets its passing spirit.

To do things with past performance as a standard is to deteriorate. Things done in the past are but milestones on the pathway of progress. They but show the advance, and point to the better way.

Augmented by imagination, planning for the distant future may or may not bring success. It is not wise to plan too far ahead else the arrival of that time may find the most efficient ideas of the past then an ignorance. Efficiency thrives in the now.

If you would be efficient, excel in everything. Be earnest, enthusiastic, loyal to your ideals and to others. Then with ambition, application and industry you will succeed.

There is but sparse competition among the men who intelligently and persistently strive.

Theorizing is often waste of time. Get action if the subject is beyond you. The solution of your problem will meet you half way if you but make a move towards it.

The efficient individual makes system an accessory, a means of accomplishing the desired end. The majority of systems are stately sarcophagi for the decent interment of dead dope. Relinquish that burden.

It is not a passive content with results but an intelligent discontent which makes for happiness and success, but in that discontent must be found the principles of individual efficiency if it is to be constructive and not the destructive force it generally is.

And about those ideals. Remember that they are a means to an end, and that end, efficiency—results.

The Joint Meeting

A compelling force is being discovered in the joint meeting with other engineering, and societies with allied interests. It widens knowledge, makes for a better understanding, and not only strengthens the position and enhances the arguments of all, especially as relating to questions of a more or less public nature, but is also urging, as a matter of economic necessity and natural development, that the professional engineer revise his present concept of what constitutes engineering practice; in this way emphasizing his civic duty and opening up several new channels as outlets for his qualified endeavor.

Engineers are proving continually that they can handle involved situations just as readily as they handle materials and forces. And why not?

The main purpose of the medical doctor is to cure disease but this does not hinder him from pursuing activities which tend to prevent those same diseases.

It does not detract from their dignity to do other than prescribe powders and pills.

And the joint meeting is discovering the engineer and bringing him into his rightful place of leader. It is beyond contradiction that the engineer has facilitated progress in all departments of endeavor—that he has been largely responsible therefor. He has therefore, nothing to gain by hiding his light under the bushel of a mistaken dignity.

It may be stated that it is the province of the professional man, whether doctor, lawyer, or engineer, to use his specialized knowledge which is power, openly, in the interests of the public.

As so pointedly stated in our leading article of this issue, the public, especially on matters involving engineering knowledge, is not a reasoning public, but governed largely by sentiment. The engineer can still further fulfill his part by actively aiding the people.

Intended to serve completely certain interests, a society is sometimes formed though there are other societies in existence which could separately solve more satisfactorily the difficulties arising. But co-ordination is lacking.

Eventually the society finds that its endeavors along certain lines are eclipsed by the specializing societies and gladly surrenders those phases of its work. The joint meeting results.

Specialization calls for co-operation, and co-operative effort completes the cycle by pointing to the necessity for specialization.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

W. R. Lyall, of the D. & W. Fuse Company, was at Seattle last week.

Marshall Tiebout Gleason, of the Gleason Tiebout Glass Company, is at San Francisco.

Ben Scranton, president American Electrical Heater Company, was at Seattle this week.

C. W. Baker, district engineer, Westinghouse Machine Company, San Francisco, is at Los Angeles.

H. E. Sanderson, Pacific Coast manager, Bryant-Perkins Company, was at Seattle during the past week.

A. C. Balch, vice-president, San Joaquin Light & Power Company, is dangerously ill at Los Angeles with typhoid fever.

H. C. Hazard, secretary, Pacific Coast Electric Railway Association, is at Los Angeles from Portland, Oregon.

H. A. Kluegel, chief engineer, Mt. Whitney Power & Electric Company, was a visitor at San Francisco during this week.

F. H. Legget, Pacific Coast manager, Western Electric Company, is making a business trip through the Pacific Northwest.

Clem A. Copeland, electrical engineer, Pacific Gas & Electric Company, is making a trip throughout Eastern business centers.

G. W. Johannsen, Pacific Coast representative Draeger Oxygen Apparatus Company, is at Los Angeles from San Francisco.

T. Mirk, of Hunt, Mirk & Company, San Francisco, is at Los Angeles, and will make a business trip throughout Southern California.

H. V. Carter, president, Pacific States Electric Company, has left San Francisco on a business trip throughout the Pacific Northwest.

L. E. Torrey, of San Francisco, left the early part of the week for Crescent City, Cal., where he will appraise the light and power plant of that city.

Ernst Kaiser is at San Francisco to study the possibility of using high voltage electric boilers for hydroelectric companies having a surplus of power.

H. H. Barrows, superintendent Oakland Lamp Works of General Electric Company, has been elected a member of the Illuminating Engineering Society.

J. B. Lukes, representing Stone & Webster Construction Company, returned to San Francisco from Boston, but has left for Los Angeles on business.

David W. Johnson, municipal engineer Point Grey, since its incorporation, has now been appointed to the same position for the municipality of Saanich, B. C.

A. G. Wishon, general manager and **A. E. Wishon**, assistant general manager, San Joaquin Light & Power Company, were at San Francisco during the past week.

E. S. Berdine, Pacific Coast representative, Gleason Tiebout Glass Company, has just returned from a business trip made throughout his territory and reports good business.

T. E. Collins, sales manager, Westinghouse Electric & Manufacturing Company, San Francisco, has just returned from a business trip made through the San Joaquin Valley.

S. P. Russell, manager electrical department, H. W. Johns-Manville Company, San Francisco, has returned from New York, where he was in attendance at the company's convention.

C. W. Whitney, erecting engineer, Westinghouse Machine Company, is at Visalia, Cal, superintending the erection of a turbine for the Mt. Whitney Power & Electric Company.

Ernest L. Clark, president of the Valentine-Clark Company, cedar pole specialists of Minneapolis, Minn., is studying conditions on the Pacific Coast. He is at present at Los Angeles and will return to Minneapolis by way of Seattle.

Henry F. Holland is at Los Angeles renewing old acquaintances, made during his residence in that city some two years ago, and to look after the Western interests of the Simplex Heating Company of Cambridge, Mass. Mr. Holland is a Jovian statesman-at-large, and is staying in this city for an indefinite time.

E. G. Eagleson, of Boise, was elected president of the Idaho Society of Engineers at the Fifth Annual Convention held recently at Boise, Idaho; **R. J. White**, of Wallace, was elected vice-president; **F. H. McConnel**, of Caldwell, treasurer; and **Ira F. Staffner**, secretary. These officers, together with **J. P. Congdon**, of Boise; **F. A. Wilkie**, of Ashton; and **E. A. Wilcox**, of Twin Falls, constitute the executive board.

F. R. Glover, general executive assistant, British Columbia Electric Railway Company, Vancouver, B. C., gave an address last week on the history of that company, and during its progress drew many interesting comparisons between the attitude of municipalities toward ownership of public utilities in the lean days of development and loss, as compared with that of the present days of deservedly earned profits. The address was enjoyed by all those who heard it.

J. Paulding Edwards, who for the past eight years has served the Northern Electric Railway Company in the capacity of consulting, constructing and operating electrical and mechanical engineer, has retired from the construction and operating departments of this company, and has been appointed consulting engineer for the company, with headquarters at 201-202 Farmers and Mechanics Bank Building, Sacramento, Cal. In addition to his work for the Northern Electric Railway Company, Mr. Edwards has entered upon general practice as consulting engineer.

MEETING NOTICES.

Jovian Dance at Sacramento.

Members of the Jovian League at Sacramento, Cal., have arranged to give a dance at the Elks Hall, Sacramento, on Saturday, February 21, 1914. Members of the Jovian order and electrical men in general are invited to attend and so contribute to the success of the occasion.

Oregon Electrical Contractors.

At the meeting held at the Commercial Club on Wednesday evening, February 11th, it was decided that the second annual convention of the Oregon Electrical Contractors' Association would be held at Portland, Oregon, June 8th and 9th, 1914, and J. R. Tomilson was elected chairman of the convention committee.

Manufacturers' exhibits are solicited and all "out of town" manufacturers' exhibits will be erected by the association free of charge..

Jovian Electrical League of Southern California.

The weekly luncheon held at Christopher's, Los Angeles, on February 11th, was attended by 87 enthusiastic Jovians, who listened to an inspiring and helpful talk by John Willis Baer, L.L. D., president of Occidental College, on "Man's Morning." Dr. Baer is a forceful and accomplished orator, and his thirty-minute address on the exercise of manhood in business dealings was a source of inspiration and mental recreation to the audience. A number of out-of-town visitors were introduced. A. L. Spring was chairman of the day.

Utah Electric Club.

The smoker given at the Commercial Club on Thursday evening, February 12th, under the direction of the entertainment committee, was the most successful social stunt in the history of the club. More than 200 members and guests were present and enjoyed to the fullest extent the program of boxing, wrestling and jiu-jitsu matches, which were freely interspersed with music by the troubadors.

The feature bout of the evening was a fifteen-minute amateur contest for the Utah Electric Club medal, to be participated in by club members only. C. J. Welti, of the West-

ern Electric Company, was given the decision over A. Young, of the Intermountain Electric Company, by a narrow margin.

Seattle Jovian League.

The Seattle Jovian League held its weekly dinner Friday, February 13th, at the Hotel Washington Annex at 6:30 p. m. The speaker of the evening J. R. Irwin of the Marconi Wireless Telegraph System, described the possibilities and accomplishments of the wireless field. Mr. Irwin was the wireless operator who accompanied the Wellman Expedition which made an unsuccessful attempt to cross the Atlantic a year or so ago. His talk was very interesting and thoroughly enjoyed by about thirty-five Jovians present. Other speakers of the evening who talked on co-operation were George R. Cooley, Mr. Gilley of the Puget Sound Traction, Light & Power Company and Mr. Cheney of the National Board of Fire Underwriters. Several selections by the Hill Quartet were rendered.

San Francisco Electrical Development and Jovian League—Alameda County Electrical Development League.

A joint meeting of these associations was held at the invitation of the San Francisco Electrical Development and Jovian League at Tait's Cafe, San Francisco, last Tuesday. The Alameda Electrical Development League, as visitors, being well represented.

W. F. Neiman and G. B. Furniss, presidents of the respective leagues, occupied the chair jointly, assisted by Carl B. Heise, vice-president of the San Francisco League.

G. B. Furniss stated what their league had done for the industry in general in Alameda County, and then called upon various members to give their views. Other addresses were also given by representative members.

It is expected that this is the forerunner of many combined meetings of a similar nature. There was a musical program also, well rendered.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The railroad commission has fixed March 1, 1914, as the date at which the new express rates of the Wells Fargo Express Company shall be effective in California. The effect of the decision is to reduce express revenues paid by the people of California by $750,000 per annum.

The railroad commission rendered a decision February 14th granting authority to the San Diego & Arizona Railway Company to issue $10,000,000, in bonds and $3,000,000 in stock for the purpose of completing its line of railway from San Diego into the Imperial Valley. The line will be approximately 140 miles in length. It will serve not only to connect the rich Imperial Valley with the port of San Diego, but it will form the western link of a possible new transcontinental railway with its terminal at San Diego.

The commission has issued a supplemental order authorizing the Southern Pacific Company to pay to the bankers and underwriters' syndicate a sum not to exceed $25,000 to cover the expenses in connection with the flotation of the $55,000,000 bond issue authorized by the commission the 9th instant. The order also authorizes the payment of the 5 per cent one year notes of the company due June 15, 1914, in the sum of $26,000,000; also a loan due May 29, 1914, in the sum of $4,500,000 and also the payment of $3,000,000 due for equipment already purchased.

The Mount Whitney Power & Electric Company has filed an application with the railroad commission, asking for authority to issue $500,000 first mortgage 6 per cent bonds; the bonds to be sold at not less than 95 per cent of their par value and accrued interest. The applicant supplies electricity to the inhabitants of Tulare and Kern counties and the funds are to be used in its hydroelectric development work on the Kaweah River.

The commission has issued an order in which it finds that the Soledad Land & Water Company, operating an irrigation system in the Salinas Valley above King City, is a public utility, and directing the company to adopt and to file with the commission rules and regulations containing provisions for the delivery of water to the land of consumers, and containing provisions that a minimum rate of $2.25 per acre per year be charged for water. The defendant held that it was not a public utility; that it could require its consumers to take water from a pumping plant; could not be compelled to operate ditches and laterals and deliver water through them to the lands of the consumers and that its rates to its consumers were not subject to review.

The Union Hollywood Water Company has filed a complaint with the railroad commission against the Pacific Electric Railway Company, complaining against the damage alleged to be sustained by the underground pipes of the Water Company which run parallel to the right of way of the railway company.

The commission has established joint freight rates between points on the San Pedro, Los Angeles & Salt Lake Railroad and the Crescent City Railway.

RAILROAD COMMISSION OF OREGON.

"The attention of the commission having been directed to a supposed dangerous condition in the operation of the underground conduits with respect to the protection of manholes while work is being performed therein, and also to the necessity of protection of cables in manholes undergoing repairs from moisture, a conference is hereby called at the commission's office in Portland, Oregon, 252 court house."

This order was issued because of a fire in an underground manhole which interrupted the municipal fire alarm system, the Western Union Telegraph System, the Pacific Telephone & Telegraph System, and the Denio Telephone Fire Alarm Company's System.

NEWS OF THE ARIZONA CORPORATION COMMISSION.

The commission ordered that the Holbrook Light & Power Company be granted authority to engage in business at Holbrook, the county seat of Navajo County, Arizona System of accounts to be that ordered by the commission and all construction and standards of construction to comply with the laws of the state. All sales of stock of company heretofore made, are void, the sale of an issue of $30,000 of common stock having been made without authority or permission.

The International Gas Company, Nogales, Arizona, was given permission to charge a monthly minimum of $1.00 per meter for gas.

BOOK REVIEWS.

Switches and Switchgear. By Professor R. Etler; translated by C. H. Laubach; 450 pages; 5½x8½ in.; cloth bound. Published by D. Van Nostrand Company, New York City, and for sale by Technical Book Shop, San Francisco. Price $4.

This excellent translation of Professor Etler's extensive work gives the engineering fraternity of England and America access to much theoretical information not ordinarily available. Regarded from a historical standpoint, this book is of great value, and should prove useful to designing engineers, but as most of the apparatus illustrated and described is of European manufacture, the details are of little value to operating engineers in this country. The ten chapters may be divided into five divisions. The first gives general information on the design of switchgear; then follow details of manufacture and design of small parts. The next subject is that of low pressure switchgear, followed by chapters on high pressure switches, and concluded by information on fuses, circuit-breakers and controllers. This text book would make an excellent addition to the library of any engineer interested in the development of this branch of electrical design.

THE ELECTRICAL CONTRACTORS' DEPARTMENT

A TYPICAL FRUIT PACKING HOUSE INSTALLATION.

BY N. W. REED.

The nature of the work carried on in buildings of this character makes it necessary to use a type of electrical fittings and a method of installation somewhat different from those used in a mercantile risk.

The following suggestions are based on requirements of the National Electrical Code. All electric fittings such as fuses, wire, switches, conduit, etc., should be Code standard. All references relate to the Code and should be so read. All work, other than that specifically mentioned herein, should be done strictly in accordance with requirements of the Code.

Main Fuses and Switch: All fuses and switches should be placed within reach, main fuses to be located at nearest accessible point to where wires enter building. (Sec. 23a.) Switch to be readily accessible and may or may not be with the fuses; a satisfactory place is with the meters or on main switchboard; it should, however, cut off the entire current, including meters. (Sec. 24a.)

Main Switchboard: Slate or marble mounted on an angle iron frame is best for switchboards, although a wood skeleton frame is suitable for a small number of large switches. In case several switches, fuses and other apparatus such as meters are to be mounted together, a wooden board covered with ⅛ in. asbestos would be satisfactory, provided no complicated wiring is to be done and all wires are kept on face of board.

In order to protect meters, fuses, switches, etc., on switchboard from mechanical injury, two heavy posts may be placed at each end of the board and about a foot in front of switches. A wooden frame covered with strong wire netting can be made which will slide up and down in front of the board by supporting the frame with window weights, similar to an ordinary window.

Fuses for Lighting Circuits: Fuses should not be placed on roof timbers or in other non-accessible places but should be grouped together at some point easy of access and where not subject to injury. (Sec. 23a.) A sufficient number of circuits should be provided so that more lights may be added and other small changes made at a later date. Fuses must be arranged so that no set of small motors, lamp sockets, receptacles requiring more than 660 watts or more than 16 sockets or receptacles are dependent upon one fuse. (Sec 23d.)

Note: This will not permit 16 sockets on a circuit if over 40 watt lamps are used and the ordinary 16 c.p. carbon lamps requires over 40 watts.

Fuses for these branch lighting circuits should not exceed 10 amperes.

Fuse Cabinets: If fuses are places in cabinets the cabinet should be well constructed and door self-closing. Bottom should be preferably on a slant so cabinet will not be used for miscellaneous storage. A wooden cabinet should be of at least ¾ in. material, painted and lined with at least ⅛ in. rigid asbestos. Doors should also be lined and close against a rabbet to be dust tight. A poorly made cabinet is worse than none. (Sec. 70.)

Supports for Wires: For open knob and tube work, wires must be kept 2½ in. apart and supports placed at least every 4½ ft. In dry places wire must be kept ½ in. from surface wired over and in damp places must be kept 1 in. from surface wired over. (Sec. 26g-h.)

Protection of Wires: Where ceilings are low or where roof timbers are far apart, do not run wires from beam to timbers and then cleat wires and fasten lamp receptacles to beam. In such places a simple method is to nail a "running board" such as a strip of 1x6 in. or 2x6 in. depending upon length of span, to the lower edge of ceiling joists or roof timbers and then cleat wirs and fasten lamp receptacles to under side of running board. (Sec. 26e.)

Protection on side walls, such as where wires come down to fuse cabinet may be accomplished by using double braid wire and placing wires in conduit, provided conduit is equipped with approved fittings and installed in accordance with requirements for conduit work. (Sec. 28.) Instead of conduit, the wires may be boxed in, when they should be kept 5 in. apart and 1 in. off surface wired over, that is, requirement for concealed work should be complied with. (Sec. 26q-t.)

Lamp Pendents and Flexible Cords: The ordinary lamp cord should not be used at all in a warehouse or packing room. If it is absolutely necessary to use a long cord extension for a portable lamp, then use a cord approved for this rough usage; such cords are known as "packing house" or "portable" cord (Sec. 54c.) For lamps not carried about, keyless weather-proof sockets could be used and suspended by twisted No. 4 stranded wire supported by a cleat and soldered to circuit wires. To control the lights, switches could be placed in fuse cabinet or snap switches placed in any convenient place.

TRADE NOTES.

The Multigap Spark Plug Company has been formed at Twin Falls, Idaho, to manufacture a spark plug recently patented by J. W. Nance.

Bids are to be opened at Fresno, Cal., on March 1st for 487 electroliers. Plans and specifications may be had from P. M. Robinson, city electrician.

B. E. Davis Electric Machinery Works, 103 E. Water street, Portland, Ore., is installing the electrical equipment in the City Market, Ice & Cold Storage Company's new addition.

Bids are now being invited by the San Francisco Board of Public Works on the electrical equipment of the new city hall. Plans and specifications were prepared by Hunter & Hudson.

F. M. Vanderlip has secured the contract for the electrical installation in the new cold storage and warehouse building being erected on the southeast corner of E. Alder and Railroad streets, Portland, Ore.

The Oregon Electric Welding & Enameling Works, controlled by Ward Watkins, has been established at 275 Hawthorne avenue, Portland, where a specialty is made of electric welding by the Thompson process.

The W. H. Smith Electric Engineering Company, Spaulding Bldg., Portland, Oregon, was awarded the electrical contract for the lighting system on the first unit of the municipal dock, Portland, Ore. The contract for the installation of the power system will be awarded at a later date.

The Western States Gas & Electric Company, Richmond, Cal., division, has closed a contract with the Shattuck-Edinger Company for 225 h.p. and a small lighting load. The power will be used by the Shattuck-Edinger Company in constructing the highway and tunnel to Richmond's outer harbor. The contract is for eight months.

The city of Pendleton, Oregon, has installed a twenty-one box municipal fire-alarm system. It is is a standard installation, consisting of a two circuit switchboard, storage batteries, bell striker, repeater and punch register. All the apparatus was furnished by the Gamewell Fire Alarm Company through their Seattle office.

NEWS NOTES

INCORPORATIONS.

LOS ANGELES, CAL.—Independent Electrical Supply Company, $25,000, subscribed $5, by I. E., I. H., E. and J. Irvine and H. Schwartz.

LOS ANGELES, CAL.—International Electric Lighting Company, $500,000, subscribed, $5, by B. T. Wilson, D. W. Shoemaker, T. L. Croom, H. W. Janicke and Mary W. Croom.

ILLUMINATION.

BAKER CITY, ORE.—The city of Baker has purchased from the Eastern Oregon Light & Power Company the entire arc lighting system in Baker for $4250.

MOLALLA, ORE.—An ordinance has been passed granting to Fred Schafer the right to erect poles and stretch wires for the purpose of transmitting electricity.

RIO VISTA, CAL.—A. Erwin of Winters, who has established a gas plant at that place, and also one at Vacaville, was here recently looking over the situation in regard to establishing a gas plant.

WASCO, ORE.—R. C. Atwood and W. H. Lee have been granted the right to erect poles, wires and other apparatus for the transmission of electricity for lighting and power purposes in the city of Wasco.

SACRAMENTO, CAL.—Bonds to the extent of $1,000,000 were authorized recently by the directors of the Sacramento Natural Gas Company. This hond issue was authorized in order to provide for extensions.

ANAHEIM, CAL.—The Southern Counties Gas Company has secured permission from the board of supervisors for laying gas mains from the La Habra district for the purpose of supplying natural gas to Anaheim and other towns.

FLORENCE, ARIZ.—Fred Tribolet and I. D. Rickerson of Ray, Arizona, have petitioned the Board of Supervisors of Pinal county, for a franchise to conduct an electric light, power and telephone business in and about the town of Superior.

GLOBE, ARIZ.—In response to a petition filed with the city council in October, 1913, the public utilities committee has made a report to the city council on the proposed installation of municipal lighting system. According to the estimates of the committee the cost of the system would not exceed $80,000.

LOS ANGELES, CAL.—Plans and specifications for installing ornamental iron lighting posts and furnishing current for ornamental lighting of Westmoreland boulevard, from Sixteenth to Washington streets, has been prepared by the city engineer and adopted by the board of public works. The council has set February 25th as the date for hearing protests to the proposed improvements.

SEATTLE, WASH.—A bill, introduced some months ago, providing for a reduction in the city's lighting rates from 6 to 5½ cents per kilowatt hour for the first sixty kilowatts, was put over another week, after more than half an hour's discussion. It was recommended for passage by the city utilities committee, but, discussion of the measure brought out the fact that a majority of the council is not ready to vote either for or against it.

SALT LAKE CITY, UTAH.—The Utah Light and Railway Company have made a proposition to the City Commission to furnish a blanket bond of $50,000 to the city, replacing the bond which is now required by the city from individual owners of electric signs to protect the city against loss by reason of damages to pedestrians from falling signs. The company is willing to do this in consideration of the commission's specifying a definite amount of illumination to be provided on each electric sign and requiring that all signs must be illuminated at least between the hours of dusk and 10:30 each evening. This blanket bond will relieve the sign owners from the expense and annoyance attendant upon furnishing an individual bond, and will have a tendency to improve the character of the electric signs installed in the city.

TRANSMISSION.

ASTORIA, ORE.—The Seaside Light & Power Company will probably extend its transmission line across Clatsop plains to the south line of Warrenton this spring, according to Manager F. J. Keyes now in charge of the plant.

SEATTLE, WASH.—The Cedar River Dam for the new city hydroelectric plant is being reared at a rapid rate by the contractors. Nettleton-Bruce-Eschbach Company, American Bank Building, Seattle. The dam will be 700 ft. in length, 200 ft. wide at the base and 215 ft. high.

CENTRALIA, WASH.—At a meeting held at Vancouver stockholders of the Washington-Oregon Corporation which operates power lines in Southwest Washington from Tenino to Kalama, the proposition of erecting a new $250,000 power house on the Kalama River was considered. It is stated that the proposed plant will be located about a mile below the old one.

RIVERSIDE, CAL.—Lee Utley, representing the Coachella Ice & Electric Company, has applied to the board of supervisors for a franchise for the distribution of electric power in the Coachella valley, from Banning to the Colorado River. Date of sale of franchise was fixed for March 18th. The company proposes to take power from the Southern Sierras Power Company at Banning and distribute it throughout the valley.

SEATTLE, WASH.—The United States attorney general has filed suit through the local district attorney's office against the Puget Sound Traction, Light & Power Company, for the revocation of five claims on the Nooksak River near Bellingham, on which is located a $2,000,000 power plant of the company. It is charged in the complaint that the patents to the claims were obtained through fraud and misrepresentation. The government alleges that the claims were filed on by P. B. Cornwall, a San Francisco capitalist; Alvinza Hayward, P. D. Connelly and D. O. Mills in 1902, and that Cornwall obtained deeds to the claims from the other three and a little later made applications for patents.

PROVO, UTAH.—The Olmstead power plant of the Utah Power and Light Company was thrown out of commission last week when 250 ft. of the flume leading to it from the Provo River was carried away by a snow and mud slide. In switching off the current when the water broke, Hyrum Fowler, superintendent of the plant, and H. Nason, his assistant, were slightly burned about their faces by an exploding arc. The water tore a great hole in the side of the mountain, leaving a sheer drop of more than 100 ft. where the flume formerly stood. S. R. Inch, superintendent of the Power Company, has a force of men at work on the foundations for a trestle which will carry the flume over the washed-out portion. He states that the service of the company has not been impaired by the loss of 4000 kw. from the Olmstead plant, owing to their ability to secure sufficient capacity from their other generating plants.

HOOD RIVER, ORE.—Hood River Valley citizens in mass meeting voted to organize about ten square miles of the valley into a municipality under a commission form of government to develop public utilities. The territory will have a population of about 6000, with an assessed valuation of approximately $6,000,000. The new municipality is the outgrowth of sentiment adverse to the Pacific Power & Light Company, of Portland, which controls the electric power and light privi-

leges of the Hood River section and which is charging the farmers 13 1-3 cents per kw.hr. It is proposed to install a municipal light plant and the territory included in the municipality to be organized will be bonded to install the plant. A motion was also passed at the mass meeting to initiate a state bill giving any rural community power to organize a municipality and to install any public utility without the necessity of the governmental requirements of the cities.

LOS ANGELES, CAL.—The three power corporations submitted to the special committee on power of the City Council a request for 10 days' additional time in which to accept or reject the contract submitted by the City Council to the corporations for the leasing of the power distributing systems, with an option to purchase them. The 10 days' additional time is necessary in order to receive the written opinion of attorneys for the trustees of their bonds, who are now considering the contract in New York City. In this connection a telegram was received by City Attorney Stephens from Dillon, Clay & King, bond experts of New York and Chicago, stating that this firm has been employed by the trustees of the bondholders of the Los Angeles power corporations. The bond experts asked whether the city would be willing to enter into a contract with the power corporations for the lease of their distributing systems. The telegram from the bond experts clearly indicates that the subject is being seriously considered by the trustee of the bondholders, and city officials are rejoicing over the prospect of this question being closed.

TRANSPORTATION.

LEWISTON, IDAHO.—The building of the 12 miles of line out of Lewiston is assured by the Nez Perce & Idaho Railway Company by the securing of a fund of $50,000.

PORTLAND, ORE.—An ordinance has been passed granting to the Portland & Oregon City Railway Company the right to construct railways, poles, wires, etc., in the city of Portland.

LOS ANGELES, CAL.—The application of the Pacific Electric Company for a franchise on Normandie avenue as a connection with the Torrance-El Segunda line, has been referred by the city council to the public utilities committee.

SAN FRANCISCO, CAL.—To expedite the delivery of materials for the construction of the new Municipal Railway lines, the city engineer has divided the present freight orders among the three transcontinental lines having terminals here.

SALT LAKE CITY, UTAH.—Three gasoline motor cars which were ordered to operate on the Orem interurban electric line between Salt Lake City and Provo pending the completion of the installation of the electrical equipment, arrived here from California under their own power last week. The cars are 61 ft. over all, and have a seating capacity of 60 passengers. Each is equipped with a 150 h.p. gasoline motor.

SAN DIEGO, CAL.—The San Diego Electric Railway Company is making preparations to expend $250,000 in improvement of its tracks on Fifth street, by replacing rails on Fifth street from Ash to University streets with Trilby or grooved rails of 114 lb. to lineal yard, and repaving the street with concrete base and asphalt surface. The rails on Fourth street from Broadway to Sixteenth street will also be replaced with 114 lb. rails.

SACRAMENTO, CAL.—Plans which will increase the efficiency of the Sacramento street railway service and which, if accepted, will necessitate the complete remodeling of the downtown system, are being formulated and will be submitted to the Pacific Gas & Electric Corporation for approval. The plan is to establish belt lines in the business district, construct new lines on I and L streets, and relieve the congestion of traffic on K and J streets, by temporarily creating a single track system in the downtown section.

OGDEN, UTAH.—In response to a communication from P. D. Kline, manager Ogden Rapid Transit Company, the Board of City Commissioners has ordered all poles removed from the center of the streets on which street car lines are operated. This order will involve a considerable expense to the Ogden Rapid Transit Company, the Utah Light and Railway Company, the Utah Power and Light Company, and the Mountain States Telephone and Telegraph Company, all of whom maintain distribution systems in Ogden. This order was made necessary by the fact that the Transit Company proposed to inaugurate a pay-as-you-enter system on its lines by April 15th.

SAN FRANCISCO, CAL.—Three tentative propositions, involving the extension of the Municipal Railway line from Stockton street across Market and thence down Fourth street to the Southern Pacific Depot over tracks of the United Railroads, has been submitted to the supervisors by the North Beach Promotion Association. With the United Railroads occupying Fourth street and assuming that the five-block limitation will prevent the city from going the entire distance, three different plans are suggested, First—the outright purchase of the right of the city to run municipal cars over Fourth street, or, second—payment to the United Railroads of part of fare collected for every passenger traveling on Fourth street, or, third—an exchange of rights, allowing the United Railroads to run a certain number of cars over the Stockton street line from the Southern Pacific depot to the Exposition grounds.

OAKLAND, CAL.—Thirty-five million dollars is the amount estimated by General Manager McLimont of the Santa Fe-Oakland Terminal Railways as necessary for the refinancing and improving of the Key Route and Oakland Traction properties and their future development along the most modern ideas of trasportation efficiency. This sum does not include the proposed extension of the Key Route to San Jose or Sacramento, but it is to be devoted to refunding outstanding bonds and to the extension and improvement within the immediate vicinity of Oakland. George C. Moore, representing the interests that recently looked over the traction properties, is now in London seeking a loan of $15,000,000 to finance the scheme, in addition to the $20,000,000 which is to be spent to buy up the outstanding bonds of the traction company, and it is expected that as soon as the final arrangements are made for the financing of the system the work of improvement will begin.

TELEPHONE AND TELEGRAPH.

LOS ANGELES, CAL.—By unanimous vote the City Council adopted the ordinance that consolidates the bureau of fire alarm and police telegraph with that of the City Electrician, and provides for the creation of an advisory board to assist in the planning of a comprehensive alarm system for the city. City Electrician Manahan thus becomes head of the fire alarm and police telegraph bureau, in addition to his duties as City Electrician, and assumes even greater responsibilities than those of his original office.

LOS ANGELES, CAL.—The Wheeler resolution, referred last week to the Public Utilities Commission of the City Council, after reciting the conditions at present that cause a double tax for telephone service on business houses and stating that other municipalities have found an interchange of service advantageous, then proceeds: "Now, therefore, Be it resolved, by the City Council, that the Board of Public Utilities of this city be and they are hereby instructed to work out a method providing for such an interchange of message from one system's lines to those of another, and establish, telephone rates with such interchange of message provided for as soon as possible, to the end that when the telephone rates are next fixed according to law they shall provide such method of interchange of messages, and thus be a great convenience, advantage and saving to the people of this city."

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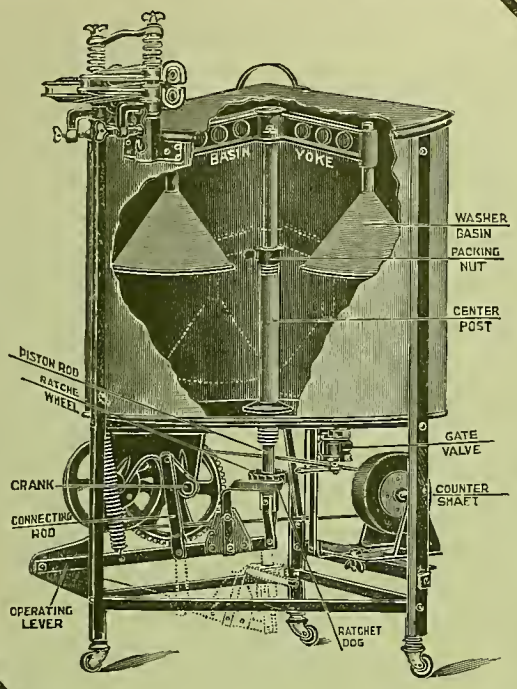
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THE INTERPRETATION OF ELECTRIC CURRENT FLOW IN TERMS OF THE ELECTRON THEORY

BY W. F. DURAND.

In terms of the electron theory, in the form in which it seems to be most generally accepted at the present time, the electron together with the socalled positive atom constitute the ultimate units of matter. The electron is also negative electricity or at least is the seat of the negative charge while the positive atom is positive electricity or at least is the seat of the positive charge. Thus matter appears as an expression of positive and negative electricity in various degrees and states of aggregation and the electron theory reduces all physical and chemical phenomena to interpretation in terms of electricity or electrical charges and the ether; or to the mutual relations between electrons and atoms of positive electricity in aggregation and in motion relative to each other and to the ether as a universal containing medium. Whether ether will ever be reduced to electricity or electricity to ether or both to some tertium quid remains for the future to determine.

No one pretends, of course, that this concept of the material universe in general or of the constitution of the molecule in particular is final or that it more than marks a stage in the gradual development of a rational interpretation of the maze of physical and chemical phenomena with which we are surrounded. The present value of any hypothesis or theory lies not in the question of its finality, but rather in its effectiveness as an aid in the interpretation and related grouping of otherwise unrelated phenomena.

If therefore matter is reducible to expression in terms of elementary electric charges and if the relations between the ether on the one hand and such elements of matter in aggregation and motion on the other are competent to explain the physical and chemical facts of the universe, then properly directed study should serve to extend either the interpretation of mechanics, physics and chemistry in terms of electricity, or of electrical concepts and phenomena in terms of mechanics, physics and chemistry.

Thus in terms of the prevailing two fluid theory of electricity in vogue immediately preceding the electron theory, the satisfactory interpretation of the phenomena of current flow in metallic conductors was scarcely possible in terms of ordinary mechanics. It was impossible to obtain any satisfactory physical or mechanical interpretation of current flow **i**, resistance **R**, electro-motive force **E** or of their various relations and combinations.

The present paper is intended as a contribution toward such an interpretation in terms of the electron theory and ordinary mechanics.

This discussion of the subject has been prepared not unmindful of the pioneer work in this field done by Drude, Riecke, Lorentz and others. The mode of treatment here followed differs, however, in some respects from that followed by these earlier writers, especially in the concept and use of a mean time of action, and the development is carried into considerably further detail with special reference to the interests of the engineer rather than those of the physicist.

Familiarity with the general concepts of the electron theory will be assumed. It will be desirable, however, to review and develop in certain detail these general concepts as applied to the matter constituting any metallic conductor, or any metal in general. We therefore assume, for any such substance, serially as follows:

(1) The matter constituting a metal is composed of molecules in a state of close aggregation.

(2) Each molecule in an electrically neutral condition consists of one or more atoms of positive electricity associated with a certain number of electrons or negative units. The positive and negative charges thus in relation are equal in amount and hence the combination is neutral in its external relations.

(3) Of the electrons which thus enter into the formation of a neutral molecule, the bond of association for a certain number (presumably by far the greater part) is of an exceedingly stable character, while that for one or more others is relatively loose, thus permitting their detachment with more or less readiness.

(4) With one or more of the loosely attached electrons separated and momentarily flying free, the residual system exhibits the characteristics of positive electrification; while the electrons themselves exhibit the characteristics of negative electrification, or in essence they are negative electricity.

(5) The molecules as systems are in a state of vibratory or periodic motion, primarily in closed stationary orbits, though under certain conditions evidences of slow migration are found. The kinetic energy of this motion is manifest as sensible heat, and the potential energy relative to intermolecular forces represents the latent heat. The sum of the two represents the total heat energy of the body.

(6) As a result of the interplay of the forces between the loosely attached electrons and the residual stable systems, and between such electrons and others momentarily flying free, there results a rapid and continuous interchange of partners among the positive atoms and the loosely attached electrons. As a result of this interplay, the inter-atomic or intermolecular spaces are in some part occupied by free flying electrons, momentarily dissociated from their stable systems and flying about much as we picture for the molecules of an ordinary gas within an inclosing chamber. Various estimates have been made of the relative time spent by the electron in the attached state or in that of free flight. Whatever may be the proper value it seems likely that on the average the time spent in free flight is considerably less than that spent as constituents of neutral atoms. In any case it is sufficient for our purpose to assume that inter-molecular space stands in relation to these free flying electrons much in the way that ordinary space does to gaseous molecules in a condition of relatively similar density, and that while thus flying free and dissociated from the metallic molecules they are at liberty to respond to the influence of an accelerating force in accordance with the same laws as in the case of ordinary matter.

It should be especially noted that the positive atoms forming by far the larger part of the mass and bulk of the substance of a metallic body are anchored definitely in place and are subject to vibratory or periodic motions only and not to a motion of translation. Furthermore any force tending to accelerate the electrons (negative electricity) in one direction will act on the corresponding positive atoms in the inverse direction. There will be therefore no action on the metal as a whole. The free electrons will however be at liberty to respond individually to such an accelerating force while the positive atoms will not.

In brief then the electron theory for our present purposes implies for the interior of a metallic body the presence of free electrons ready to respond to a suitable accelerating force, with positive and neutral atoms anchored fast and subject to motion of a vibratory or periodic character only.

From this concept it follows further that with a body under the influence of no electric force the free electrons as a group or as a whole have no velocity relative to the metal. That is, their motion has no resultant vector value, no more than has that of the molecules of a gas in a closed chamber relative to the chamber itself. There is motion and momentum in every direction in space, but for every resultant in one direction there is an equal and opposite in the other. This is exactly analogous to the condition of the molecules of a gas within a closed chamber, and in many respects the status of the free electrons within a metallic body may be satisfactorily represented by the details of such an analogy.

With this by way of introduction, let us consider a closed metallic circuit, with the following characteristics:

Substance, uniform.
Cross section, uniform and of area **a**.
Length, **l**.
Number of free electrons per unit volume, **n**.
Total number of free electrons **N**.
Then we have:
Number of free electrons per unit length = **na** and

$$N = nal \quad \ldots\ldots (1)$$

It should be noted that **n** does not mean the number of detachable electrons per unit volume or the gross number which may, over a period of time participate in such movement, but rather the number per unit volume actually flying free at any one instant. If the unit of volume were sufficiently small and if the time basis of the count were likewise sufficiently brief, **n** would doubtless be a variable. With fixed physical conditions and for volumes and times which have significance for the problem in hand, **n** is a constant. For different substances or for varying physical conditions, and with special reference to temperature, **n** presumably becomes a variable, increasing with decrease of temperature and decreasing inversely.

Next let **m** denote the mass of an electron and **e** its electric charge, or in other words the amount of electricity (negative) represented by one electron.

Omission is purposely made of variation of mass in the electron with velocity. For velocities of the order presumably involved in conduction through metals, such differences are negligible.

Let us now assume an electric force of intensity **f** to act on the electrons along the line of the circuit. This force is to be considered as acting steadily and thus developing, during the times when the electrons are free to yield to such force, a uniformly accelerated motion along the line of the circuit.

The total force acting on an electron with charge **e** will be **fe**, and the consequent acceleration will be **fe/m**.

The result of the action of such an accelerating force will be to impress on the free electrons in addition to whatever actual velocity of flight they may have, a component velocity along the direction of the circuit. This may be called the impressed velocity to distinguish it in magnitude and direction from the actual velocity of flight which the electron may have as a result of the physical and thermal state of the metal.

Now at any given instant there will be **N** electrons flying free. Let **t** denote the time during which any one has been free and subject to the action of the accelerating force. Then throughout the entire group of **N** electrons **t** will have values varying from 0 for an electron just emitted up to some maximum value representing the longest period of free flight. Let **u** denote the impressed velocity for any given electron. Then

$$u = \frac{fet}{m} \quad \ldots\ldots (2)$$

There will be as many of these individual velocities as there are electrons or **N**. Denote the mean value

of u by v and the mean value of t by z, then we have

$$v = \frac{fez}{m} \quad \ldots\ldots (3)$$

This average velocity v is the velocity of translation for the N electrons as a group, and is, therefore, the group or statistical velocity for the entire aggregate of free electrons at any one instant.

Then relative to this group velocity v we have

nam = mass of electrons per unit length.
namv = group momentum per unit length.
nae = electric charge per unit length.
naev = electric momentum per unit length.

The latter expression is also the measure of the transfer of electricity (negative) past a given section in unit time, and is therefore a measure of current flow. We have, therefore, with the usual notation

$$i = naev \quad \ldots\ldots (4)$$

Again, for an individual electron, denote the kinetic energy relative to its impressed velocity by k. Then

$$k = \frac{mu^2}{2} \quad \ldots\ldots \text{(See Appendix 2.)} \ldots\ldots (5)$$

$$\text{and } \frac{dk}{dt} = mu \frac{du}{dt} \quad \ldots\ldots (6)$$

$$\text{But } u = \frac{fet}{m} \text{ (eq. (2))}$$

$$\text{and } \frac{du}{dt} = \frac{fe}{m}$$

$$\text{Hence } \frac{dk}{dt} = \frac{f^2 e^2 t}{m} \quad \ldots\ldots (7)$$

But dk/dt is, for a single electron, the time rate of energy change (increase) under the action of the accelerating force, and there will be N such elements of energy change, all of the same form. Hence the summation of such elements will be the time rate of change (increase) of the total kinetic energy of the system of N electrons relative to their impressed velocities. Denoting such total energy by K we have

$$\frac{dK}{dt} = \Sigma \frac{dk}{dt} = \Sigma \frac{f^2 e^2 t}{m} = N \frac{f^2 e^2 z}{m} \quad \ldots\ldots (8)$$

This is then the time rate at which the kinetic energy of the N electrons in free flight is increasing under the action of the accelerating force. But if we assume steady conditions, the kinetic energy of the free electrons as a group must actually remain uniform. It can neither continuously increase nor decrease. It must be subject therefore to a loss through absorption within the molecules at exactly the same rate as that of increase due to the action of the accelerating force.

In order to more clearly develop the situation, the character of the group movement of the free electrons must be considered in some further detail. The picture which we have formed of such movement implies for the individual electron a discontinuous history including periods of free flight and intermediate periods of absorption within the molecule. Such absorption of the electron within the molecule implies the disappearance of its free flight velocity and the absorption of its corresponding kinetic energy. In general therefore the kinetic energies of the free electrons relative to their free flight velocities become merged with those of the molecules upon their absorption by the latter. When such molecules again emit free electrons, their direction of flight at the instant of escape is as likely to be in one direction as another, and hence they will have, on the whole, no resultant velocity along the conductor and no energy relative to a group or translation velocity. It results that the act of collision with and absorption by a relatively fixed molecule robs the electron entirely of the energy corresponding to its share of the group velocity v, such energy being added to the heat content of the conductor and in the usual case ultimately dissipated as such. If this reasoning is correct, we may then identify the heating effect in the conductor with the energy absorbed from the free electrons, and quantitatively the time rate of such heat generation (Ei or $i^2 R$) with the time rate of energy transfer from the free electrons to the molecules of the metal. With this picture before us it is clear that the electrons serve simply as a carrier of energy from the source of the electric force through to the molecules where it becomes manifest as heat.

This relation enables us therefore to equate the time rate of the heating effect in the circuit, measured by Ei or $i^2 R$ in electrical terms, to the time rate of energy change in the group system due to the action of the accelerating force. We have therefore

$$Ei = i^2 R = \frac{N f^2 e^2 z}{m} \quad \ldots\ldots (9)$$

We next assume that the mean value of the time of action, z is determined by the physical conditions of the body and that it is constant under fixed physical conditions. (See appendix I.)

Then from (3)

$$fe = \frac{mv}{z}$$

and substituting in (8) we have

$$Ei = i^2 R = \frac{Nm\, v^2}{z} \quad \ldots\ldots (10)$$

But Nm is the total mass of the free electrons, v is the group velocity and z the mean time of action, is constant under fixed physical conditions. Hence the rate of work Ei or rate of heating $i^2 R$ is proportional to the kinetic energy of the free electrons relative to their group velocity in the circuit; and denoting such kinetic energy by K we have

$$Ei = i^2 R = \frac{2K}{z} \quad \ldots\ldots (11)$$

$$\text{or } K = \frac{Eiz}{2} = \frac{i^2 Rz}{2} \quad \ldots\ldots (12)$$

Equation (9) may also be written

$$Ei = Nfe \frac{fe\, z}{m} = Nfe\, v \text{ (see (3))}$$

But Nfe = electric force acting on entire group of free electrons. Denote this by F. Then

$Ei = Fv$ = force x velocity ..... (13)

= rate of doing mechanical work.

Again from (10) we have

$$E = \frac{Nm\,v^2}{iz}$$

Substituting from (1) and (4) we have

$$E = \frac{nal\,mv^2}{naevz} = \frac{m\,v\,l}{ez} = fl \text{ (see (3))} \quad \ldots\ldots (14)$$

$$\text{Also } R = E \div i = \frac{m\,v\,l}{eznaev} = \frac{m\,l}{nae^2z} \quad \ldots\ldots (15)$$

Let σ denote specific conductivity.

Then by the definition of the term:

$$i = \frac{\sigma\,a\,E}{l}$$

$$\text{whence } \sigma = \frac{li}{a\,E} = \frac{lnaevez}{amvl} = \frac{ne^2z}{m} \quad \ldots\ldots (16)$$

$$\text{or specific resistance} = \frac{1}{\sigma} = \frac{m}{ne^2z} \quad \ldots\ldots (17)$$

The same expression may also be derived directly from the value of R in (15).

For the total accelerating force F we have

$$F = Nfe = \frac{nalmv}{z} \text{ (see (3))}$$

$$\text{or } F = nae\,E \text{ (see (14))} \quad \ldots\ldots (18)$$

$$\text{and } E = \frac{F}{nae} \quad \ldots\ldots (19)$$

Gathering these various results together we have

$$i = naev = \frac{nafe^2z}{m}$$

$$E = \frac{mvl}{ez} = fl = \frac{F}{nae}$$

$$R = \frac{ml}{nae^2z}$$

$$\sigma = \frac{ne^2z}{m}$$

$$Ei = \frac{Nmv^2}{z} = F\,v$$

$$Ei\,z = Nmv^2$$

$i^2R = Ei$ as above.

$i^2Rz = Eiz$ as above.

$$F = naeE = \frac{NeE}{l} = Nfe$$

$$Fl = NeE$$

Expressing these results in words, we have as follows: Current flow i is measured by the rate of flow of negative electricity past a given section in unit time, or otherwise by the electric group momentum of the free electrons per unit length.

With fixed values of m and e the electromotive force per unit length of circuit varies directly with the group velocity v and inversely with the mean time of action z. With a circuit under constant physical conditions the e.m.f. per unit length varies directly with the group velocity. Or otherwise the e.m.f. per unit length equals the intensity f and the total e.m.f. is measured by the work done by a force f acting through the length of the circuit l, or by the work done in moving unit charge through such length. Or otherwise the e.m.f. equals the total accelerating force divided by the electric charge carried by the free electrons per unit length of circuit.

With fixed values of m and e, the resistance varies directly as the length, and inversely as the cross section, as the number of free electrons per unit volume and as the mean time of action z.

With fixed values of m and e the specific conductivity varies directly as the number of free electrons per unit volume and as the mean time of action z.

The power Ei and heating effect i^2R vary directly as the kinetic energy of the group system N relative to the velocity v and inversely as the mean time of action z. Or otherwise they are both measured by the product Fv the rate at which the force F does work on the electrons in the circuit.

The total force F is measured by the product of the e.m.f. and the electric charge carried by the electrons per unit length.

Suppose a system of units, the most fundamental possible in nature, and in which the unit of mass is the mass of the electron and the unit of electric quantity or charge is that carried by the electron. Then in the above equations both m and e will become unity and the various expressions will become much simplified. It will be of interest for the reader to pass these various equations and expressions in review with this simplification and to note the physical or mechanical interpretation in such simplified form. This will serve to bring out in the plainest possible manner the relation between the various electrical quantities and the specifications of the circuit as determined by the physical characteristics a, l, n, z.

APPENDIX I.

Regarding the assumption that the mean time of action z is constant under fixed physical conditions, the following points may be briefly noted.

Picture the N free electrons at any instant. These individual electrons will have varying free paths tranversed in varying times and beginning and ending at varying instants of time. In particular the times of free flight will vary between certain limits and according to some law of distribution about a most frequent value.

Picture again the same N free electrons at any instant. Individually they have been free and under the action of the accelerating force for periods of time varying from zero for an electron just escaping from an atom to the time of flight for the longest free path.

We have then two kinds of time intervals to consider and two mean times

(1) The times of free flight and their mean.

(2) The times of action of the accelerating force and their mean.

Now from the known values of the masses and forces involved and from such inference as can be applied to the problem, we must assume that the actual velocities of the electrons in free flight are high. We may not unreasonably

assume velocities of the order of .001 that of light or even higher. On the other hand, our best knowledge of the factors involved shows a very low value for v, the group velocity of translation.

Thus following such estimates as have been made let us take one ampere per second or one coulomb equal to 8.79×10^{18} electrons, and the number of free electrons per cubic centimeter of copper of the order 380×10^{18}. We shall then have by way of illustration for a No. 8 copper wire carrying a current of 25 amperes an actual group velocity of the order of 7 centimeters or a little less than three inches per second. More generally with these same estimates we shall have

$v = 4570\ i/d^2$ centimeters per second.

$= 1870\ i/d^2$ inches per second.

Where

i = current in amperes.

d^2 = circular mills in conductor.

These results show the very low order of group velocity which is entirely competent to explain the facts of current flow.

It follows that impressed velocities of this order will have no measureable influence in lengthening or shortening the time of free flight of bodies moving actually with enormously greater velocities and hence no matter what current may be flowing, the velocity of translation will not sensibly affect the times of free flight or the mean of such times.

It follows that the times of action as above defined will be similarly independent of the amount of current flow, and hence for any given substance under constant physical conditions such individual times and their means may all be assumed independent of the e.m.f. and the current flow, and dependent solely on the nature and physical state of the body.

It may be here stated, without detailed proof, that examination shows the mean time of action, as here defined and used, to be one-half the mean free time of flight, or one-half the mean free life of the electron.

APPENDIX II.

The measure of the change in the kinetic energy of the electrons due to the action of an accelerating force acting along the line of the conductor may be developed as follows:

At any time t after its emission let the component velocity and direction of motion of an electron, so far as due to forces other than the accelerating force, be w in a direction θ with the line of action of the accelerating force.

Let the velocity due to the accelerating force which has been acting during the time t be u in the line of action of the force, u being small compared with w.

Then the actual velocity at this instant will be the resultant s given by

$$s^2 = w^2 + u^2 + 2wu\cos\theta.$$

Let k = kinetic energy. Then

$$\frac{1}{m}\frac{dk}{dt} = \frac{d}{dt}\frac{s^2}{2} = w\frac{dw}{dt} + u\frac{du}{dt} + wdu\cos\theta + udw\cos\theta$$

This is the time rate of change of the kinetic energy of one electron. There will be N such elements and in the summation of the enormous number actually involved we shall have statistically an indefinite approach toward equal positive and negative summations for the terms $w\frac{dw}{dt}$, $wdu\cos\theta$ and $udw\cos\theta$. That is, for every value of w with a positive value of dw there is likely to be found an equal value of w with an equal negative value of dw and for any combinations of either wdu or udw with a positive value of $\cos\theta$ there is likely to be found an equal combination with an equal negative value of $\cos\theta$. Hence in the summation all terms will vanish at the limit except $u\frac{du}{dt}$, and we shall have therefore

$$\frac{dK}{dt} = \Sigma\frac{dk}{dt} = \Sigma mu\frac{du}{dt} = \frac{Nmv^2}{z}$$

as in (6), (7), (8), (10).

ELECTRIC RAILWAYS IN COLORADO.

Preliminary figures of the forthcoming quinquennial report on the electric railways of the state of Colorado have been given out by Director W. J. Harris, of the Bureau of the Census, Department of Commerce. They were prepared under the supervision of W. M. Steuart, chief statistician for manufactures.

The statistics relate to the years ending December 31 for 1912 and 1907, and June 30 for 1902. The totals include the electric division of a steam road and electric light plants operated in connection with electric railways and not separable therefrom, but do not include railways under construction which had not begun operations during the census year.

The figures as presented for Colorado show that during the decade 1902-1912 there were substantial gains in the industry. The increase of the 16 operating companies reported in 1912 over 1902 was 8, or 100 per cent, and their aggregate gross income shows an increase of $4,402,714 (198 per cent), and their net income increased $867,605 (222 per cent) over 1902. The miles of track were increased 233 (100 per cent), and the number of revenue passengers carried was 44,226,000 more in 1912 than in 1902, an increase of 104 per cent.

The figures in detail are shown in the accompanying table:

Colorado.	1912.	1907.	1902.	Per cent of increase:[1] 1902-1912.
Number of companies	17	11	9	88.9
Operating	16	11	8	100.0
Lessor	1	..	1	.....
Miles of line	348.43	206.36	154.17	126.0
Miles of single track	467.97	317.37	234.53	99.5
Cars, number	785	631	393	99.7
Passenger	551	474	352	56.5
All other	234	157	41	470.7
Persons employed	2,498	1,738	1,053	137.2
Salaried employes	226	133	74	205.4
Wage earners (average number)	[2] 2,272	1,605	979	132.1
Power plant equipment:				
Horsepower, total	48,532	21,790	9,690	387.3
Steam and gas engines, including turbines:				
Number	28	23	32	—12.5
Horsepower	43,332	19,910	9,710	346.3
Water wheels:				
Number	5	5	1	.....
Horsepower	5,200	1,880	250	.....
Kw. capacity of dynamos	29,692	13,634	6,275	373.2
Output of stations, kw.-hr	97,915,436	42,110,616	17,859,576	448.3
Current purchased, kw.-hr.	8,458,015	[3]	[3]	.....
Passengers carried	107,502,972	93,683,653	[4] 52,327,717	105.4
Revenue	86,597,205	73,458,468	42,371,590	104.4
Transfer	18,813,014	18,362,433	9,956,127	89.0
Free	2,092,753	1,862,752	[3]	.....
Car mileage (passenger, express, freight, etc)	17,202,137	14,596,838	[4] 8,925,060	92.7
Condensed income account, operating companies:				
Gross income[5]	$6,630,480	$4,483,254	[4] $2,227,766	197.6
Operating expenses	3,264,753	2,099,421	1,300,606	151.0
Gross income less operating expenses	3,365,727	2,383,833	927,160	263.0
Deductions from income (taxes and fixed charges)	2,106,967	1,273,024	536,005	293.1
Net income	1,258,760	1,110,809	391,155	221.8

[1] A minus sign (—) denotes decrease.

[2] Number employed Sept. 16, 1912.

[3] Figures not available.

[4] Exclusive of 1 company which failed to furnish this information.

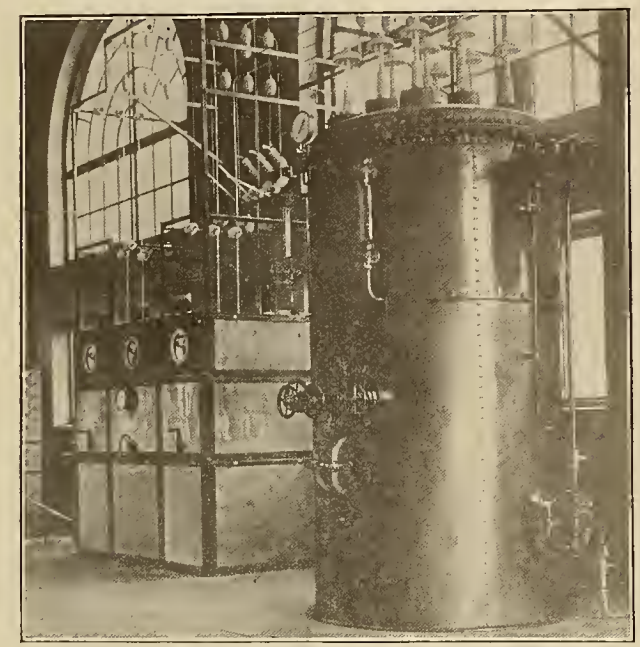
[5] Income from sale of current for light and power included: 1912, $1,064,247; 1907, $344,468; and 1902, $111,104.

Normal wet concrete carrying currents increases its resistance a hundred-fold or more in the course of a few weeks, which fact still further lessens the danger of trouble due to electrolysis.

GENERATING STEAM ELECTRICALLY.

BY ERNEST KAISER, M. E.

For utilizing surplus hydroelectric energy there has been developed in Europe a high voltage, alternating current electric boiler which can be run on the primary current, without transformer. For a number of years plants consisting of units with capacities ranging from 500 kw. up to 2000 kw. each and voltages from 2200 up to 12,000 volts, have been in continuous operation. The first plant on this side of the Atlantic is in course of erection in Eastern Canada, comprising two single units of 750 kw. each, on 2400 volt, three-phase current, star connected, to produce steam of 125 lb. pressure for heating a cotton mill during the night hours.

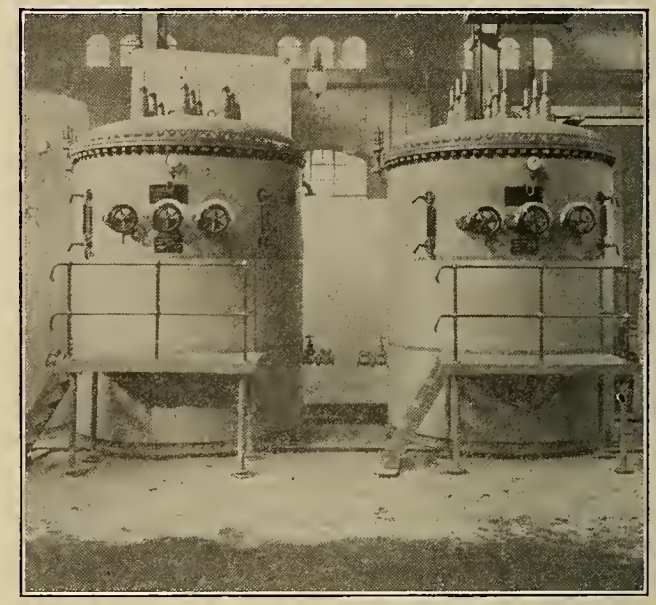


First Electric Boiler Installation.

In countries, like Canada or Sweden, where coal is comparatively expensive and the cost of water development low, there are quite a number of cases when the production of hydroelectric steam warrants the initial cost of additional development of the hydraulic end, especially on the consideration of building a manufacturing plant, like a mechanical pulp mill, nearer to its source of raw material. Still oftener it is economical to equip the mechanical-electrical end of a hydroelectric development before its ultimate completion, when needed to satisfy an enlarged local demand for light and power, as in many cases where space has been provided for future hydraulic turbo-generator sets. Furthermore standby hydraulic generator sets can often be thus utilized to pay their initial cost, while being ready at a moment's notice to be switched off the electric boilers into service on the line.

In localities where fuel-oil is cheap, as in California or in Russia, hydroelectric steam has its special field. In standby stations for hydroelectric systems, a part of the steam boiler battery is constantly kept supplied with warm water and steam, so as to be ready on short notice, in case of an emergency, to supply the line with current. The practice is to alternately heat one boiler at a time and keep each boiler connected with the other boilers of a battery. The fuel consumed for this stand-by service which may not be called upon for a long time, is quite considerable in some plants, and where there is a hydroelectric surplus, constantly or off-peak, a sufficient saving can often be shown to warrant the additional cost in two or three years, as this electric steam equipment is relatively inexpensive.

There are no changes in the outlay of a steam station necessary as the electric boilers can be run parallel to the fuel-oil boilers, feeding directly into the main steam pipe of the fuel-oil boiler battery. The



Canadian Installation of Electric Boilers.

space needed for an electric boiler plant is rather small. For instance a boiler of 2000 kw. capacity measures 8 ft. in diameter and 12 ft. in height, a 750 kw. boiler 6½ ft. in diameter and 11 ft. in height.

The thermal efficiency of these boilers is claimed to be 98 per cent, the builders guaranteeing 93 per cent on full load and 88 per cent on half load. For a preliminary estimate one can assume that 1 kw.-hr. produces about 3 lb. of saturated, dry steam at commercial pressures up to 125 lb.

It would lead too far to give full details of the boiler in a short article, especially to show, why by means of some of the patented features of this boiler, this boiler operates successfully when so many previous attempts towards this end have utterly failed. It may suffice to state that the water itself is used as a resistance, the current being taken into the boiler to a fixed electrode and divided into a primary current which travels between the fixed electrode and a movable electrode, and into a secondary current. The electrodes are within non-conducting tubular bodies that take in the water on one end and discharge the steam on the other end. The electrodes are arranged in groups and all surrounded by water within the boiler.

By shifting on the boiler the distance between the electrodes and by switching on or off the various

groups, on the switchboard, a fine regulation in all steps from full load to one-third of its capacity can be attained. The supply of feed water is usually regulated by the help or can be made automatic, the quality of water has to be the same as for a first class fuel-steam boiler. The equipment is made to approve with the fire underwriters' regulations, the risk being smaller than with ordinary coal boilers.

The boiler is designed to avoid accidents automatically by its own inner working, and is said to be fool-proof. The builders state that it needs little attention, that no scale is formed, and few repairs necessary, the only parts that have to be renewed every few years being some inexpensive iron electrodes.

Similar to this application in stand-by stations, where the fuel-oil boiler battery offers the natural heat storage into which the electric boiler empties, there are smaller projects of using electric boilers in isolated stations for heating purposes, where in off-peak hours an electric boiler stores its surplus into a reservoir. For example an old Scotch boiler shell can be thus used as a container under pressure.

GAS BUOYS ALONG THE CANAL.

In conformity with Section 4678 of the Revised Statutes of the United States all the buoys in the Canal are colored and numbered, so that in entering the channel at Colon, and extending south to Miraflores Locks, red buoys with even numbers shall be passed on the starboard hand, and black buoys with odd numbers on the port hand. On entering the channel at Naos Island, and extending north to Miraflores Locks, at the Pacific entrance, red buoys with even numbers are placed on the starboard hand, and black buoys with odd numbers on the port hand.

Buoys on the port side will use double flashes, those on the starboard, single flashes, as follows: Buoys on starboard tangents have a characteristic of five seconds light, five seconds dark; on port tangents, two seconds light and one second dark, two seconds light, 3.8 seconds dark. Turning buoys on the starboard hand have a characteristic of .3 second light, 2.7 seconds dark; on the port hand, .3 second light, .7 second dark, .3 second light, 1.7 seconds dark.

The general custom for channel or river lighting is to have red lights on the starboard hand and white lights on the port hand, but with the perfection of devices which produce rapid flashes of whatever duration desired, it is likely that this method will eventually be superseded by the method of single and double flashes of white light on either side of the channel, especially in localities frequented by heavy fogs and rains, where the maximum efficiency of a light is required. To obtain a red light it is necessary to use ruby glass, and such glass absorbs about 75 per cent of the light. At the Atlantic and Pacific entrances to the Canal, parts of which may be navigated without Canal pilots, red flashing lights will be tentatively used on the starboard hand, but in all other parts of the Canal white lights will be used unless they are proved to be confusing.

PROPOSED HYDROELECTRIC BILL.

(On February 7, 1914, Mr. Jones introduced the following bill in the United States Senate. It was read twice and referred to the Committee on Irrigation and Reclamation of Arid Lands. It is commented upon in our editorial, "Aiming to Aid," which appeared in our last issue.—The Editors.)

A Bill (S. 4415),

To aid and to regulate the development, operation, and maintenance of water powers on lands of the United States, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled:

That in order to utilize for the benefit of the public the waterpower resources of the public lands of the United States, and in order to prevent the unregulated monopoly of said water powers, the right to construct, develop, maintain, and operate storage reservoirs, canals, conduits, waterpower or hydroelectric plants, transmission and distributing lines, and all other appurtenant constructions and appliances on, over, and across any part of the public lands of the United States, reserved or unreserved, including national forests and Indian reservations (but excluding national parks, monuments, and military or other lands reserved for governmental purposes), is hereby granted, upon compliance with the conditions hereinafter imposed, to any state or municipal subdivision thereof or to any public service corporation organized for the purpose and authorized by the state or states in which any portion of such dam, storage reservoir, waterpower or hydroelectric plant, or transmission or distributing lines may be located, to engage in the business of furnishing to the public water for domestic, irrigation, transportation, or any other purpose, or light, heat, power, or energy generated by electricity or otherwise. Such state, municipal subdivision, or public service corporation is hereinafter referred to as the "grantee."

Sec. 2. That any grantee hereunder may construct, develop, maintain, and operate water-storage reservoirs, canals, conduits, waterpower or hydroelectric plants, transmission and distributing lines, and all other appurtenant structures and appliances on, over, and across any part of the public lands of the United States, reserved or unreserved, including national forests and Indian reservations (but excluding national parks, monuments, and military or other lands reserved for governmental purposes), upon filing with the Secretary of the department having jurisdiction over such lands plans and specifications for such works, together with such drawings of the proposed construction and such map of the proposed location and flooded area as may be required for a full understanding of the subject, which plans, specifications, and drawings shall be approved by such Secretary if it appears to him that the proposed development will promote the highest and greatest practicable use of the water resources involved. Within ninety days after the approval of such plans, specifications, and drawings said grantee and such Secretary shall agree upon the then fair market value of the lands proposed to be occupied which are owned or controlled by the United States, and in the event of their failure to agree within such time, then such grantee shall have the right to, and may, begin proceedings in the district court of the United States for the district in which such lands or any part thereof may be located for the purpose of determining the then fair market value thereof. Such district court is hereby given jurisdiction of said proceedings for such purpose, and service of process may be had upon the clerk of said court, and upon such service being made the Attorney General of the United States shall enter his appearance for the United States. Such proceedings shall be conducted according to the laws

Upon an agreement being reached as to the fair market value of said land between said Secretary and the grantee, or in the event of their failure to agree, then upon the final adjudication of the value of said land by said court the grantee shall have the right to occupy said land for the purposes above set forth for a period of fifty years after such agreement or final adjudication, and after the expiration of said period of fifty years such right shall continue until compensation has been made to the grantee for the fair value of its property as herein provided. During the occupancy of said land by the grantee it shall pay into the treasury of the United States annually, in advance, a sum equal to five per centum upon the fair market value of such land as so determined by agreement or final adjudication, and the liability for such payment shall constitute a preferred claim against all the assets of the grantee and may be collected by suit brought in the name of the United States, and in the event of the failure of the grantee to pay any judgment and costs recovered in such suit, then such judgment may provide for ejecting said grantee from said premises and for the forfeiture of the grant.

Sec. 3. That in the acquisition of the property of the grantee, as hereinafter provided, no value shall be claimed by or allowed to the grantee for the use of or the right to aud rules in force in said jurisdiction at said time for the exercise of the right of eminent domain for public purposes. use the lands acquired under the terms of this act, but in any adjudication for rate-making purposes by any court or public service commission the rental so paid shall be included as a necessary operating charge.

Sec. 4. That at any time after the expiration of the said fifty years congress may terminate the right to occupy such land and provide for the taking over by the United States, or by any state within which such land may be located, or by any municipal subdivision of such state, of all of the property of the grantee dependent for its usefulness upon the rights hereby granted, which shall include all necessary and appurtenant property created or acquired and valuable or serviceable in the distribution of water, or in the generation, transmission, or distribution of light, heat, power, or energy, and by paying to the grantee the fair value of said property, and assuming all contracts entered into by said grantee which have the approval of the duly constituted public authority having jurisdiction thereof, or which were entered into in good faith and at a reasonable rate in view of all the circumstances existing at the time such contract was made. Unless otherwise provided by congress, the method of determining the fair value of said property, and the reasonableness and good faith of such contracts, shall be by agreement between the Secretary or Secretaries of the department or departments then having jurisdiction over such lands and the grantee, and in the event of their failure to agree, then by proceedings instituted by the United States in the district court of the United States within which such land may be located.

Sec. 5. That in order to prevent tying up, for speculative purposes, any of the lands to be acquired under this act, the grantee shall commence the construction of the project within two years from the date of the agreement, or in the event of failure to agree then the date of final adjudication, as to the value of the land to be occupied, and shall thereafter, in good faith, continuously, and with due diligence, prosecute such construction, and shall within the further term of five years complete and put in commercial operation such part of the ultimate development as the Secretary or Secretaries of the department or departments then having jurisdiction over such lands shall deem necessary to supply the reasonable needs of the then available market, and shall from time to time thereafter construct such portion of the balance of such ultimate development as said Secretary or Secretaries may direct and within the time specified by said Secretary or Secretaries, so as to supply adequately the reasonable market demands until such ultimate development shall be completed, and no extensions of the periods herein specified shall be granted except by the President, and then only when, in his judgment, the public interest will be promoted thereby.

Sec. 6. That rates charged by all grantees under this act shall be reasonable and the service and operation shall be adequate and efficient, and all such grantees shall be subject to lawful regulation in the public interest as to rates and otherwise by the respective states having jurisdiction thereof: Provided, however, That the United States reserves the right to regulate rates and service to the consumer should the business of the grantee be or become interstate, or should the states or local authority fail to regulate such rates or service.

Sec. 7. That the rights granted by this act shall, upon application, inure to the benefit of any state, municipal subdivision thereof, or public service corporation, as defined herein, which is now constructing or operating any dam or accessory works, or any water storage reservoir, or waterpower or hydroelectric plant, or any transmission or distributing lines and their appurtenances or appliances on the public domain, provided such state, municipal subdivision thereof, or public service corporation shall comply with all the terms and provisions hereof.

Sec. 8. That all waterpower reserves may be opened by the President to location, settlement, entry, and disposal under the appropriate public land laws, so far as the same will not impair, prejudice, or destroy the use of the land for waterpower development, generation, transmission, or utilization, it being the intent of this section that so far as possible lands available and necessary for waterpower and for other purposes shall be used for all purposes, the waterpower, however, being the dominant use, which reservation shall be expressed in all patents issued for such land.

Sec. 9. That the works constructed and maintained under authority of this act shall not be owned, leased, trusteed, possessed, or controlled by any device or in any manner so that they form a part of or in any way affect any combination in the form of an unlawful trust, or form the subject of any contract or conspiracy to limit the output of electric energy or in restraint of trade with foreign nations or between two or more states or territories, or within any one state or territory in the generation, sale, or distribution of electric energy.

Sec. 10. That all acts and parts of acts inconsistent with this act are hereby repealed, and the right to alter, amend, or repeal this act is hereby expressly reserved.

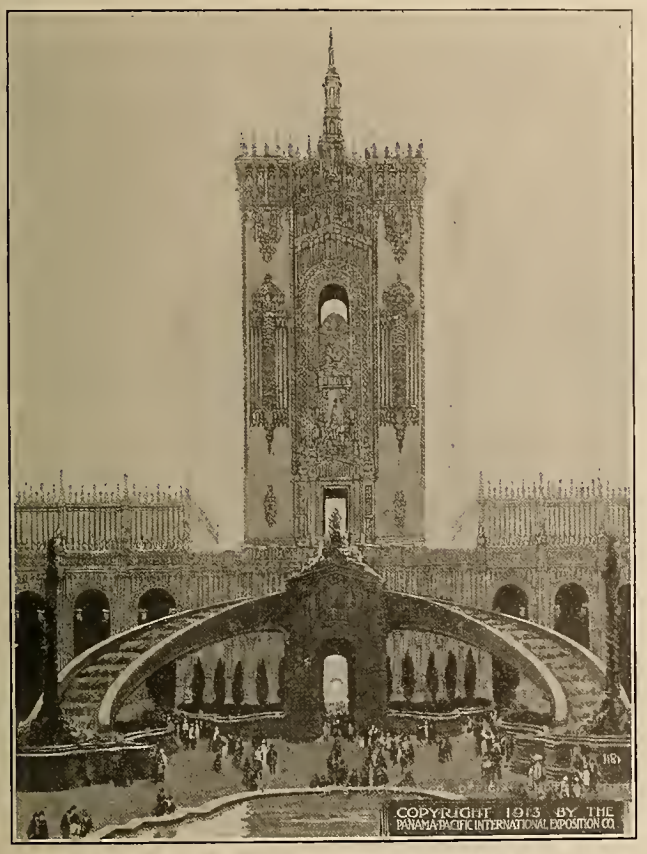
The largest system of electric railways in Canada is at Vancouver, B. C., where the British Columbia Electric Railway Company, Ltd., has a total mileage in operation as of December 31, 1913, of 371 miles. During the year the lines around Vancouver city were extended by the addition of ten miles of trackage, but a larger development took place on Vancouver Island where the Victoria city system was extended 26 miles up the Saanich peninsula, opening up a very rich agricultural and summer resort district. During the year the company have added to their rolling stock three double truck passenger cars, 60 freight cars, 3 sweepers, 15 logging cars and two combination passenger and mail cars. The total equipment at present consists of 902 cars.

LIGHTING EFFECTS WITH GAS AND STEAM.

BY WALDEMAR H. F. N. DE BILLE.

Steam and gas will be extensively used in some of the original schemes for night illumination of the Panama-Pacific International Exposition. It is believed that some of the most spectacular effects will be gained where these are combined.

This will be particularly noticeable in the Court of Abundance in which the architect has taken for his theme the creation and development of the earth and has presented a symbolic idea of the history of man from the prehistoric day to the present. The rise of man and the development of the earth has been treated by a series of graduated scales; the lowest form, or the



Cascades of the Court of Abundance.

unicellular life being presented on the ground level and the various stages of advance noted on ascending planes.

The court will be illuminated almost exclusively by means of high pressure gas. Urns will be placed about the court and on the borders of a still lagoon in the center, from which twisted gas flames ten to fifteen feet in height will rise.

Great sheets of flame will lick the fire-proof sides of the court and rise along the facades and up the scores of columns supporting huge carved figures of prehistoric men.

A haze will hang over the entire court created by steam forced through perforated pipes laid along the ground level. The cloudy vapor and the reddish-yellow flames will produce an effect of mystery which the entire architectural scheme will carry out.

It is the intention of the designer to have gas released under pressure just beneath the surface of the water in the lagoon which will be ignited upon striking the air. The details of this ingenious plan, however, have not yet been worked out.

As a substitute for the usual pyrotechnic displays, steam will be used at the Panama-Pacific International Exposition. While this is not unique, having been successfully used to a slight degree at the Hudson Fulton celebration in New York, this will be the first occasion upon which it will take the place of fireworks.

Set pieces of pipe in various shapes are being made and placed near the Scintillator—a battery of forty-eight 36-inch searchlight projectors—on the bay front of the site. Through these pipes steam under high pressure will be forced to a height of three hundred feet or more. An automatic device at the base will cause the steam to be turned on for a certain number of seconds and then shut off.

The vapor will assume form under the colored rays of the Scintillator, waver and dissolve like wraiths into the upper air.

The gas used at the Exposition will be distributed through a high pressure system by a San Francisco company and will be the oil gas made of crude petroleum commonly used in California. Its heat value is 600 B.t.u. per cu. ft. and it has a candlepower value in excess of 18. Being exceptionally free from sulphur and other impurities it will be used for heating in all of the buildings. A low pressure system will also be operated at about six inches water pressure for lighting purposes in the various buildings.

FREE MOTORS FOR P. P. I. E. EXHIBITORS.

A communication has just been received by the Panama-Pacific International Exposition from one of the largest manufacturing concerns of electrical motors, offering the free use of as many motors as are desired by exhibitors at the Exposition.

The Exposition has been anxious to have as many exhibitors as possible operate their machinery under regular working conditions in order that the public may see just how the various products are made and that intending purchasers of machinery may judge the comparative merit under working conditions.

This offer from a large electrical firm, which will unquestionably be duplicated by others, will be of great assistance in promoting this undertaking.

The various conditions specified by the electrical company follow:

"1st. The exhibitor to pay all transportation charges to and from nearest free delivery point.

"2d. Exhibitor to pay for all repairs other than ordinary wear and tear.

"3rd. Exhibitor to furnish any special pulleys or couplings. We will furnish standard pulleys free of charge.

"5th. All consignments to be handled by district office in whose territory exhibitor is located.

"7th. The exhibitor should understand that we reserve the right to hang a suitable sign on the motor, stating that it was loaned by us."

The offer is made generally for motors up to and including twenty-five horsepower, but the communication explains that in the event that a larger motor is desired the application should be made in a different manner. The fourth and sixth clauses refer to the details of making application for the loan.

It is believed by the Exposition that an arrangement may be made whereby the products of the exhibitor manufactured on the ground may be profitably handled by him.

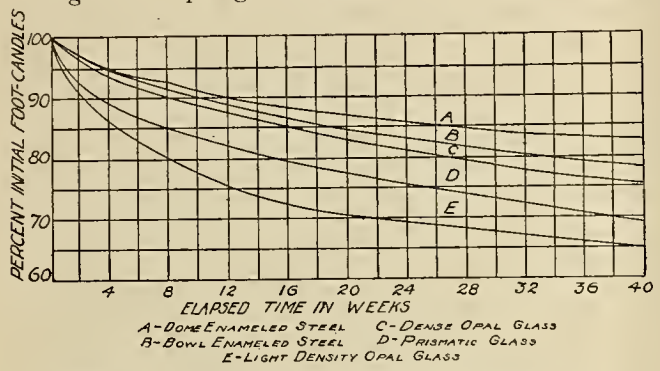
LIGHTING METHODS

PLANNING LIGHTING INSTALLATIONS.

BY J. B. JACKSON.

(Concluded.)

The collection of dust and dirt affects different reflectors in varying degrees as is shown by the diagram which is presented by the courtesy of the National Lamp Works of General Electric Company, giving graphic representation of tests made at Cleveland. The vertical scale representing per cent of the initial illumination value and the horizontal scale the time elapsed is weeks. Curve A represents the results obtained from a dome shaped enameled steel reflector; Curve B, a bowl shaped reflector of the same material; Curve C, a heavy density opal glass; Curve D, Prismatic Glass; Curve E, Light density Opal. In referring to an opal glass reflector in terms of its density it must be remembered that the term density refers to optical not physical density and is also independent of the thickness of the glass. The lighter density the opal, the higher is the light transmission value. The Prismatic glass used in the test was the type which is familiar to all, consisting of a reflector of clear glass with carefully designed prisms on the exterior surface.



Effect on Intensity of Illumination Due to the Collection of Dirt and Dust on Lamps and Reflectors.

Contrary to the general belief these tests show that prismatic glassware is not affected by dirt to as great a degree as is the light density opals. Under this latter classification will come the most of the opal glass which is being used commercially. These tests did not include any figures on indirect lighting but it has been stated, as a result of tests made that the figures of 10 per cent per month holds for at least the first two months when mirror reflectors are used. As this last figure corresponds fairly well with results on the curve it would indicate that the position of the reflector has not as great bearing as has been supposed.

If we would set 15 per cent as the allowable depreciation on lamps and reflectors the cleaning period would be six weeks for indirect, Prismatic, light and medium density opal reflectors; and 16 weeks for steel and heavy density opal reflectors.

The designer of lighting installation can accomplish a great deal by impressing upon his client the necessity of regular cleaning periods. It is not uncommon that installations have been known to be allowed to go without cleaning for a period of more than a year. Such an installation might give only 25 to 50 per cent of its initial illumination value, if the reflector used were of light density opal.

In referring to systems of lighting, three terms have come into general use, Direct, Semi-Indirect and Indirect. The lines of demarcation between these classes are rather hard to draw, but present definitions are about as follows; the term Direct lighting is applied to systems in which a large part and in some cases all of the illumination on the working plane is received directly from the lighting units (lamps and their equipment); Indirect when no light is received directly but is obtained by reflection from ceilings and walls; Semi-Indirect when only a part is received directly, the greater percentage being obtained indirectly.

Light on the working plane is composed of two parts, the light received directly from the unit, plus a portion of that directed toward the walls and the ceiling and reflected back upon the plane of illumination. It is evident therefore that color of walls and ceilings very materially affect the total illumination, as color is an indication of the absorption of light, i. e. the darker the color the higher the absorption value; the exception to the above rule being units which direct practically all of the light toward the working plane.

Table 4—Watts Per Square Foot to Produce One Foot Candle Illumination. (Watts Per Lumen.)

Type of Lighting Equipment.	Ceiling Light. Walls. Light.	Ceiling Light. Walls. Medium.	Ceiling Light. Walls. Dark.	Ceiling Medium. Walls. Light.	Ceiling Medium. Walls. Medium.	Ceiling Medium. Walls. Dark.	Ceiling Dark. Walls. Medium.	Ceiling Dark. Walls. Dark.
Mirror (Bowl Type Direct)	.180	.186	.196	.183	.193	.196	.196	.196
Prismatic (Clear)	.180	.204	.208	.225	.240	.263	.263	.270
Prismatic (Satin Finish)	.230	.251	.277	.257	.277	.309	.309	.337
Prismatic (Velvet Finish)	.200	.220	.240	.220	.240	.251	.277	.284
Opal Enclosing Unit	.300	.327	.360	.384	.372	.416	.491	.540
Prismatic Enclosing Unit	.216	.230	.245	.240	.251	.284	.300	.309
Opal Reflector (Heavy Density)	.200	.208	.225	.216	.225	.235	.235	.235
Opal Reflector (Medium Density	.216	.235	.251	.240	.251	.284	.292	.300
Opal Reflector (Light Density)	.229	.251	.277	.263	.277	.308	.318	.327
Enameled Steel Dome Shaped)	.204	.216	.225	.208	.220	.225	.225	.225
Enameled Steel (Bowl Shaped)	.225	.235	.245	.229	.240	.245	.245	.245
Semi-Indirect	.251	.284	.318	.386	.415	.470	Not recommended.	
Indirect (Mirror Reflector)	.349	.386	.415	.514	.568	.635	Not recommended.	
Bare Lamp	.270	.309	.372	.309	.372	.432	.450	.514

Color Classification.

Light.	Medium.	Dark.
White	Yellow	Green
Light Gray	Light Blue	Brown
Cream	Light Buff	Red

In planning a lighting installation it is essential to consider all the quantities which affect the illumination results, namely, architectural features intensity required, kind of lamp, type of auxiliary equipment, decorations, etc. In order to simplify matters

as much as possible a table has been made up containing all these variables excepting the intensity required for the service. In doing this it has been necessary to assume a lamp for general use for this purpose, the 100 watt Mazda lamp of the January, 1914, rating has been selected. In making calculations average lamp depreciation of 3.6 per cent has been allowed for. However, the large sizes of lamps will give somewhat higher results while the smaller sizes will give lower, so for the exact values of lamps other than the January, 1914, 100 watt Mazda multiply results in the table, by the quantity under multiplying factor in the table of Lamp Values, Table 1.

Below Table 4, is given three colors under each of the classifications, Light, Medium and Dark, these are given as a guide for classifying the different conditions of ceiling and walls. Figures are given in three places although no especial significance should be attached to the last decimal place.

Problem.

As an example of the method of calculation, assume the following conditions:

Width of space	40 ft.
Length of space	40 ft.
Ceiling height	60 ft.
Ceiling color	Light
Wall color	Medium

Service requirements—general office illumination without desk lamps.

Type of the equipment—medium density opal.

Area, 40x60—3400 sq. ft.

From Table 3, 10 ft. spacing of units is the best adapted for the given ceiling height and dimensions of the space considered.

From Table 4 constant for medium density opal with light ceiling and medium walls—.235 watts per sq. ft. required to produce one foot candle illumination.

From Table 2 intensity required for office purposes under the conditions named is 4.0 foot candles.

Number of units—24.

Area per unit—100 sq. ft.

Intensity value x constant—watts per sq. ft.

4.0 x .235—.94 watts per sq. ft.

Depreciation, 15 per cent.

.94 x 1.15—1.02 watts per square foot to be provided.

1.08 x 100—108. watts per outlet.

As an example of the use of other types of incandescent units if it were desirable to use candelabra carbon lamps reference to Table 1 shows that the 100 watt value obtained when using tungsten lamps must be multiplied by a constant tabulated in the last column, namely 3.10 from which it is evident that to obtain the same illumination results it is necessary to use 310 watts in the lamps designated.

The steps to be taken in planning a lighting installation should be as follows:

1. Determination in a general way the type of lighting to be used considering decorations and service required.
2. Spacing of outlets from architectural considerations.
3. Intensity required.
4. Calculation of capacity of outlets.
5. Selection of fixtures with reference to mounting height, accessories (glassware, etc.), and of general design to conform with architectural treatment of buildings.
6. Wiring installation.

What will be the advantage of this method? First—the lighting installation will be made a part of the general design and not have the appearance of being an afterthought. It will become a means of accentuating the architectural features. The ideas of the designer will be brought out by artificial light as well as by daylight. Second—the installation cost will be practically fixed, without "extras," and explanations to the client as to the over running of the electrical appropriation. Lastly: There will be greater satisfaction to all.

It is to be remembered that the plan of procedure indicated in this paper is not given as a set of hard and fast rules, but rather as a suggestive method to be used as a basis of design. Also that the mere fact of obtaining a certain intensity value on the working plane does not constitute all the necessary considerations in planning.

One system may be suitable for some certain class of service which would be very much out of place in another. The scope of this paper does not permit any discussion of this phase of the subject as it is impossible to lay down any general rules which cover all cases. It is hoped that each individual case be given special study and that a general betterment of conditions of artificial illumination will result.

CAN YOU ANSWER THESE QUESTIONS?

(Your answers to these questions submitted by readers would prove of value if published. Your viewpoint would be appreciated. You are also invited to submit your own lighting problems for solution through this same channel.)

My questions are based on the material set forth in "The Lighting Book," by F. Laurent Godinez.

1. In a living room 14x20 ft. that has thrown across one end and back again part way of one side a glass enclosed porch 8x24 ft., and 10x10 ft. at one end, would it be practicable to have a lattice ceiling above which are concealed two 40-watt tungsten lamps shaded by the gelatine films that Godinez recommends, this overhead lighting to be independent of several reading lamps?

2. Where can I secure the gelatine film used in theatrical lighting?

3. Is there any one in San Francisco who makes plaster articles like an art lamp with plaster column and capital, such as Godinez illustrates on page 102, and says on page 99 that such plaster effects are inexpensive, and that a small glass dome of mottled glass to surmount the column may be had for $1.00?

The room in question is in a semi-bungalow or cottage, and I wish to try these new lighting effects. The cottage is to be built up country, and the lighting company would probably oversee the wiring, and might, of course, be able to answer these questions, but from long experience, I find that one does not get information concerning such innovations in a valley town.

Z. L. L.

The result of frosting lamp bulbs is to appreciably decrease the useful life, but is justifiable where "bare" lamps are used, as is often the case in artistic installations. Frosting increases the end-on candlepower, but the total flux of the lamp is reduced approximately 7 per cent. The total hours or actual life of the lamp is not greatly reduced.

NIFTY LESSONS IN SALESMANSHIP.

BY W. L. GOODWIN.

(Upon urgent request this article together with a paper on "An Analysis of Salesmanship and Training of Salesmen as applied to the Electric Supply Business,"—which appeared in this journal for May 31, 1913,—were presented by Mr. Goodwin, vice-president Pacific States Electric Company, at a recent meeting of the San Francisco Electrical Development and Jovian League.—The Editors.)

Getting the Order by the "Do and Don't Route."

I will, in this paper, endeavor to give you a few "Nifty Lessons in Salesmanship," will not treat the subject as a science, but rather take you from the "sublime to the ridiculous," but, nevertheless, hope that by comparison with previous ideas, ridicule, or any other manner extract from these lines a few Do's and Don'ts, which will help you in your endeavor to fatten your pay envelope and reduce the net earnings of the company.

I will show you how to approach the most fractious customer, bridle his attention, harness his interest and lasso his order; how to open and close a sample case scientifically and carry it with one hand, how to board and unboard trains, how to register at a hotel so as to draw a room big enough to peel off a union suit without spraining the wallpaper, how to make 27 towns a day without hurrying, how to put an automobile in your expense account without even the gasolene smelling, how to come in smiling after a turndown and make the Dear Firm laugh merrily and tell you what a good fellow and fine salesman you are when you haven't sold a bill of goods in six months.

I think I am qualified to show you all these things. For the past seven years I have traveled the whole of Marin county, on the main line from Sausalito to Camp Meeker, have also walked the ties from Camp Meeker to Monte Rio and made many side trips in addition. I have stayed awake nights figuring expenses in an endeavor to balance an expense account of a Camp comprised of friends and relatives in order to strike a balance that would pass muster of all, my wife included.

In covering this great expanse of territory I have had an experience, have been able to observe, and gained an insight into the psychology of Salesmanship that few men on the road never get next to.

Those of you who are blessed with the good fortune never to have slept out nights or in railroad depots, who are without previous road experience, should be enabled with these few suggestions to sell electrical supplies as easy as it is to sell whisky in a dry town.

Thousands of my former associates in the Sales Department of the eleven hundred companies I have represented are now balancing themselves on the apex of success without parachute or pole. They are stars in the firmament of commerce, sparklers on the shirt front of the electrical industry, and so on as far as you like.

One of my students is now at the head of one of our largest electric trucks. He's delivering the goods to our customers right along. Another has opened the largest retail electrical store in San Francisco. He's been opening it every morning for the past year also the windows. And many others meeting with similar success. In fact, we have in our own organization, good paying sales positions standing around getting bow-legged, waiting for competent men to come and get them.

The thing is to become a millionaire and say what you please. It is hoped these "Nifty Lessons in Salesmanship" will make you one. As one formerly in the Sales Department wrote me. "I followed your advice, got everything in sight and now have a steady job, without traveling. Yours No. 1450."

I will now endeavor to point out how to sandbag an order without killing it, and if my advise is adhered to, success will follow on all fours.

Many salesmen think that all you need on the road is ability. Wrong! You've got to have something to sell, some definite tangible line of goods.

You couldn't expect a buyer to look over samples of nothing in particular and besides, it is difficult for a salesman to formulate a selling talk on something that wasn't anything but a bunch of nothing. Just picture yourself selling the vacuum in a Mazda lamp.

If the buyer should happen to ask at the end of a two hours' hot selling talk what your line was, it would be embarrassing to have to reply that you did not know. You might lose the sale if you made such a break.

Therefore, you must have something to sell, and it must be a line suitable to the trade you call on. You can't sell ice cream at the North Pole any more than you can sell hot coffee at the equator.

Before starting out you should know something about your line and not leave it to your customer to explain it to you. If you are selling sockets for instance, you should know which end to screw the lamp into. You also should know a socket from an arc lamp. I well remember a certain salesman who was trying to sell weatherproof wire. After he had been on the road for several months he called on me. I asked him what other kinds of wire his company made. He replied without a moment's hesitation: "Why, all kinds of course." The facts were they only made weatherproof, office and magnet wire. He didn't get the order. The company ceased manufacturing shortly after, and no doubt the calibre of their selling force had something to do with it.

The moral of this, of course, is know what you are selling and be able to side-step trouble without breaking your back.

The next thing to know is how to approach your customer, or your "prospect," as he is often called, no matter how slim a prospect he may be. The approach may be said to be the arc lamp hanger of the sale. Much depends upon it.

A weak approach, like a weak lamp hanger may mean the loss of something.

The approach must be made in such a way that your customer does not hide in the waste basket or hang out the "Too busy" sign. Always call at your customers' office or place of business when you want to sell him. Don't call at his home, nor try to interview him during church service or while he is back of the house chasing butterflies.

Many salesmen dislike to break into their prospect's office while he is busy reading the morning

newspaper or amputating a hang nail, but this should not deter you. If you were to come around again you might find he had gone to the ballgame with your competitor. Such is the daily drudge of the tired business man.

Always enter your customer's store or place of business through the door, not the transom or the chimney. The front door is generally used for this purpose and a little experience will show you how to tell it from an automobile.

Do not walk up and down in front of the store a dozen times before making up your mind to enter.

Make up your mind before you get on the premises and then march right up and open the door in a determined, business like manner, closing it firmly after you. The way the door is opened and closed indicates character.

A near salesman once wrote in for instructions on how to open and close doors. I wrote to him, giving what I thought full information. He wrote back saying that the first place he visited they had revolving doors. He didn't know how to work them and he couldn't get in, so he lost the sale, and then lost his job for losing the sale.

Once inside drop your sample case back of something so they won't know what you are. It's better to be taken for anything than a salesman. You get waited on sooner. If you are not carrying a sample case you need not be so particular.

The Getaway.

The next thing to do is to find out if your man is at home. There is no use trying to talk to him if he is not there.

The best way to find out is to ask somebody. Don't go rummaging through the desk drawers or looking under the table. Ask some employe of the place. If the employe says the boss is out, turn him around and look at the back of his neck. You can ascertain in this way if he is lying. I don't know how you can tell, but you can.

If your customer is really away and won't be back for a couple of months, it wouldn't be advisable to sit around the place waiting for him to return.

I knew of a salesman one time who sat around a store every day for a month, waiting for Mr. Souse of the firm of Souse & Company. All of a sudden it occurred to him that he would inquire just when Mr. Souse would return. Approaching a clerk with the question, "would you mind telling me just when you expect Mr. Souse back?" "We don't expect Mr. Souse back at all," replied the clerk calmly. He's been dead for twenty years. The business is merely run under his name.

You see, therefore, it is not only necessary to find out if your customer is away, but also when he is expected back, if at all.

Finding your man at home, however, changes the situation. The thing to do then is to discover the best way to make him stand still long enough for you to get up close to him. When you get up close to him, cough twice. That will attract his attention. Then throw your hat on his desk, followed by your card if you have one. If you have and it contains your name, that is all you need. A card with the name of the firm, your photograph, age, and family record, is not necessary.

I assume by this time you have got your customer's attention and the thing to do now is to hold it. If you haven't got his attention, you might as well talk to the stars. The only salesman who can talk his line when his customer isn't listening is the insurance solicitor. He's got his talk down so fine that he doesn't even listen to himself.

Attention is secured through one or more of five senses. Some salesmen show their samples when their customer is not looking. They expect him to hear the samples. Others talk when their man is not listening, expecting him to smell the conversation. This last can't be done unless you are using pretty strong language. The nifty salesman will soon discover which of the five senses to appeal to in order to command attention.

Some salesmen find the sense of sight a short cut to attention. Some salesmen can attract attention by doing sleight-of-hand tricks with an ordinary tomato. The customer, at first indifferent, soon finds himself fascinated and guessing for all he's worth where the juicy tomato has vanished to.

It's up your sleeve he says excitedly. "That's where you're wrong," replies the salesman; "you are sitting on it." Now, the question is—did he get his attention?

To get attention you must know what you are selling and what you are going to say. If your memory is bad, put your selling talk in writing. When you start to read your paper, he will be so surprised that he is bound to be attentive.

Interest is stretched attention.

Be sure your selling talk covers the merits of your goods. If they haven't any merit, invent some. Never run down your goods. Your competitor will do that. Should it so happen that you cannot think of any good things to say about your goods, ask your customer if he can think of any.

Or, you can excuse yourself for a few days while you write to the house for some dope.

The able salesman, however, will think up a million reasons why his customer should buy. He'll fill the air with arguments. In this way, you get the bug of desire into your customers' system. Desire is the third verse in the "Song of the Sale." You must make your customer long for your goods. Tell him what a darn fool he'll be if he doesn't buy, call him any name he'll stand for. Tell him how you sold a million dollars worth of goods yesterday. If at any time your customer shows slight signs of weariness such as yawning or falling asleep, arouse him with a left uppercut. If he laughs so long that you suspect he's purposely delaying the sale, tell him you didn't come to see him make a fool of himself, and to sit up and behave.

Once get your customer taking orders from you like that, and you'll have him where you can take an order from him.

Desire.

Having finally thrown the halter of Desire over the head of your customer, you now lead him gently up to the trough Resolve.

A "Resolve to buy" is the connecting link between the near sale and the sale. No matter how delirious with admiration your customer may be over your goods, if you can't bring him too long enough to have him make some coherent statement to the effect that he will Buy some of your stuff, you are a class Z Rum Salesman.

Right here, nevertheless, is where many salesmen go to the mat. They are able to coax their victim right up close to the trap where he can sniff the cheese, but they can't get him to sink a tooth into it. They lack judgment, slipping over a syllable too much, or a syllable too little.

I once lost an order for two carloads of socket bushings by excusing myself at the psychological moment, taking up the customer's telephone, to find out who won a prize fight. I afterwards learned my customer was a deacon in a church.

Sometimes when your customer stands hesitant upon the point of decision, just a gentle shove is needed to send him over the line of Desire into the safe territory of Resolve; but many salesmen think they are out with a football squad and they shove him over on his ear and he gets up red and sore.

The keen salesman should know the psychological moment, and not expect it to come out and cough, sneeze, wave its arms or give other nervous evidence of its presence. Psychological moments never do that. To get the order signed is the delicate operation. The very instant you flash your order pad, a strange something comes between you and your man. You can't see it but you can feel it. It is as thick as a wall around a penitentiary. Up to that time, all may have been like a still moonlight night on a lake, but at the sight of that order pad a storm rises from a clear sky. For that reason the order pad should be introduced without any accompanying brass band. Don't whip it out of your pocket as if you were pulling a gun. It's bad enough. Call your customer's attention to something on the ceiling, or tell him to close his eyes a moment, or look out of the window. While he is falling for it, flash the pad and begin filling in name, date, terms, etc.

Before he has time to head you off, ask him if two carloads would be too many and when he says "My-God-yes," then put down the number that he thinks will be about right. When you have written down everything that your customer needs and a lot that he doesn't need, and never will need, then ask him in a courteous way to please sign his name on the dotted line. Be sure he signs on the dotted line. Otherwise the treasurer would not know his signature from yours.

If he becomes suspicious about signing the order, assure him that everything is on the level by showing him our rating, pictures of our new building, with which every salesman should provide himself at his own expense, initials in your hat or on your linen, etc.

If it is an installment sale and you happen, by accident, to have the necessary contract form wih you, even though it may appear to him to be a mile long, and done in knotty legal terms, all about heirs, executors and legatees, explain to him very carefully that the contract really doesn't mean anything, that it is only made out in that way so the firm can hang him in case he doesn't pay for the goods. If you do not reassure him in this way, he will be afraid that when he signs the contract for a few washing machines for instance, he is signing away the old homestead, and he will get so webbed up in reading the 49 clauses of the contract that he won't know whether he is the party of the first part or the party of the second part or merely the goat.

And as it is a cinch that you yourself don't know, by all means enlighten him.

Now, then, when you finally succeed in getting the order signed—Beat it—Beat it—Beat it. Don't give him time to cut it down or change his mind. You came for that order. You got it. Beat it. Don't grab your hat and run or he will suspect you have pinched his overcoat or umbrella. Merely shake his hand warmly and go. Don't be too joyous, or he'll think it's the first order our house ever landed.

If your customer is of dignified bearing or otherwise afflicted it is well to leave him some little word of respect and good cheer such as "Good luck to you, old sport, behave yourself," or something like that. It helps cement friendships, and makes him feel easy about the order he was chump enough to give you when he really didn't need anything.

When you are once out of sight, go into the nearest saloon, ask yourself politely to have a drink and a big black Havana, twenty-five straight.

Then charge up two dollars in your expense account for a lunch. It's worth it.

The boss is a boob anyhow and he won't know. He can't tell the difference between a phoney item in an expense account and a mercury arc rectifier. Didn't I get the order. What more does he want. Brown spent thirty cents last week and I am not going to thrown Brown down. Suppose the boss does kick. The house is losing money anyhow and besides what is two dollars. Didn't I make four dollars profit on the order and ain't I entitled to half, or better still, charge it up to Pullman. There never was a Pullman on the line you travel on, but two dollars looks good to me so I might as well make the bluff anyhow.

But the main thing to remember boys, is to get the order, and do it without charging the house with the two dollars you didn't spend.

And so, I wish good luck to all of you. I hope these few suggestions on "Nifty Salesmanship" will help you in your daily grind.

Nitrogen Filled Lamps for Street Lighting have been adopted by Seattle, Washington, which is the first city to adopt this new lamp for ornamental street lighting. A number of 80 c.p., 6.6 ampere type lamps have been installed on standard five-lamp posts, the lamps being fed from individual 250-watt transformers in each pole base. These transformers take current from the 120-volt mains and deliver it at eight volts to the lamps. It is expected eventually to replace all the old-type tungsten lamps in Seattle by the new nitrogen-filled units. The new lamps were shipped to Seattle from the factories of the National Quality Division of the General Electric Company.

WATER POWER SUIT.

The Beaver River Power Company and L. L. Nunn of Utah have been made co-defendants in a suit in equity instituted by the Government on grounds similar to those which formed the basis of the suit still pending against the Utah Power and Light Company.

The action involves the right of the power company to occupy and hold possession of lands within a national forest reserve for the development and transmission of hydroelectric power without having obtained permission from the Interior Department and the payment of a rental.

It is alleged that since July, 1911, the defendants have engaged in the operation of hydroelectric power works located on what is now designated as the Fillmore National Forest without having secured permission from the Government to do so. Its existence on the land is alleged to be a trespass.

The complaint asks that the defendant be required to secure permission for the possession of the lands and also to reimburse the Government for a reasonable amount of rental during the period of the past occupancy.

The case opens up the whole subject of Federal and State control of the public domain. The power companies hold that they are entitled to the lands under the Federal act of 1866, while the Government contends that the provisions of this act, which provided for the occupancy of the public domain for power sites, were repealed by implication contained in the later Federal act of 1896, which laid down regulations by which easements for limited terms of years could be secured.

Teh first case to be brought under the Government's construction of the law governing such power sites on the public domain was that against the Utah Power and Light Company. The decision rendered in the local United States District Court was in favor of the defendant company, but on an appeal to the United States Circuit Court of Appeals, the decision of the lower court was reversed last October. The case is still pending on a motion for a re-hearing before the Court of Appeals.

The case was filed for the government by W. W. Ray, just appointed District Attorney.

ELECTRIC LIGHT AND POWER IN CALIFORNIA.

Preliminary figures of the forthcoming quinquennial report on the central electric light and power stations of the state of California have been given out by Director W. J. Harris of the Bureau of the Census, Department of Commerce. They were prepared under the supervision of W. M. Steuart, chief statistician for manufactures.

The statistics relate to the years ending December 31 for 1912 and 1907, and June 30 for 1902, and cover both commercial and municipal electric plants. They do not include electric plants operated by mining companies, factories, hotels, etc., which consume the current generated, those operated by the Federal government and state institutions, or plants that were idle or in course of construction.

The figures as presented for California show substantial gains for the decade 1902-1912. The number of establishments showed a slight decrease, being 112 in 1912 as compared with 115 for 1902. The total income for 1912 was $27,685,573 as compared with $5,066,417 in 1902, or an increase of 447 per cent. The total expenses for 1912 were $22,803,526 as compared with $3,918,975 in 1902, or an increase of 482 per cent. The total number of persons employed was 5738 in 1912 as compared with 1360 in 1902, or an increase of 322 per cent. The total horsepower of the engines was 416,186 in 1912 as compared with 55,855 in 1902, or an increase of 645 per cent. The horsepower of the water wheels was 432,062 in 1912 as compared with 78,933 in 1902, or an increase of 447 per cent. The output of stations amounted to 1,747,459,041 kilowatt hours in 1912 as compared with 152,728,042 in 1902, or an increase of 1044 per cent. The estimated number of arc lamps wired for service was 24,890 in 1912 as compared with 15,764 in 1902, or an increase of 58 per cent. The number of all other varieties of lamps wired for service was 6,793,200 in 1912 as compared with 1,006,875 in 1902, or an increase of 575 per cent. The horsepower capacity of the stationary motors served with electric current amounted to 603,742 in 1912 as compared with 50,296 in 1902, or an increase of 1100 per cent.

The figures are shown in detail in the accompanying table:

California.	1912.	1907	Per cent of increase:[1] 1902.	1902-1912.
Number of establishments	112	129	115	—2.6
Commercial	97	115	105	—7.6
Municipal	15	14	10	50.0
Income[2]	$27,685,573	$14,416,529	$5,066,417	446.5
Light, heat and power	$26,461,154	$13,922,028	$4,946,090	435.0
All other sources	$1,224,419	$494,501	$120,327	917.6
Total expenses, including salaries and wages	$22,803,526	$12,580,937	$3,918,975	481.9
Total number of persons employed	5,738	3,128	1,360	321.9
Total horsepower	848,248	384,673	134,788	529.3
Steam and gas engines (including turbines)—				
Number	180	167	156	15.4
Horsepower	416,186	149,884	54,843	658.9
Water wheels—				
Number	205	172	133	54.1
Horsepower	432,062	208,444	78,933	447.4
Auxiliary engines:				
Number	([3])	45	44	.....
Horsepower	([3])	26,345	1,012	.....
Kilowatt capacity of dynamos	588,281	238,480	83,816	601.9
Output of stations, kilowatt hours	1,747,459,041	661,606,309	152,728,042	1,044.2
Estimated number of lamps wired for service:				
Arc	24,890	[4] 19,691	15,764	57.9
All other varieties	6,793,200	[4] 3,068,214	1,006,875	574.7
Stationary motors served:				
Number	29,059	11,560	5,190	459.9
H.P. capacity	603,742	200,067	50,296	1,100.4

[1] A minus sign (—) denotes decrease.

[2] Exclusive of $75,817 in 1912; $366,566 in 1907; and $279,216 in 1902, reported by street and electric railway companies as income from sale of electric current for light or power, or from sale of current to other public service corporations.

[3] Not reported separately.

[4] Exclusive of 373 arc and 16,996 lamps of other varieties reported by the electric companies as used to light their own properties. Lamps used for such service were included in the number reported for 1912.

EFFECT OF FORESTS ON RUNOFF.

BY J. C. STEVENS.

(Concluded.)

Uniformity of Flow.

I wish to present briefly a few data on this subject, since it is the main issue so far as forestry effects are concerned. I have chosen streams in pairs, existing under the same climatic conditions, some with forest drainage areas and some without forests.

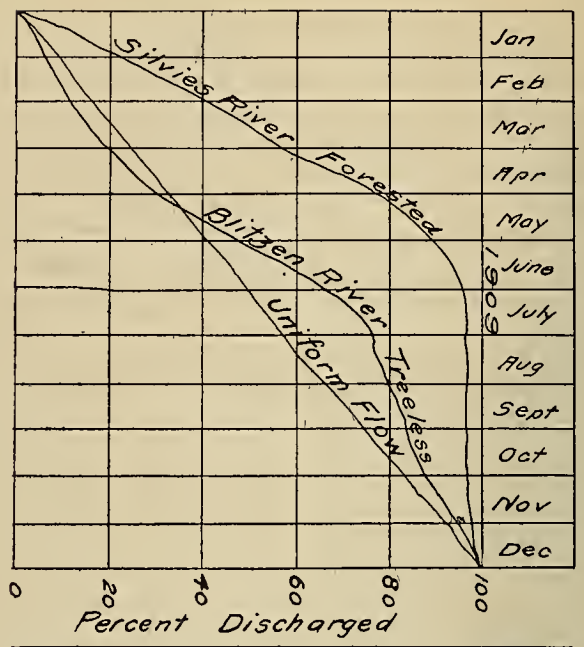
Of course, it is futile to draw conclusions or to attempts to obtain a measure of forestry effects from such comparisons; nevertheless, the causes of uniformity of flow are well worth an investigation.

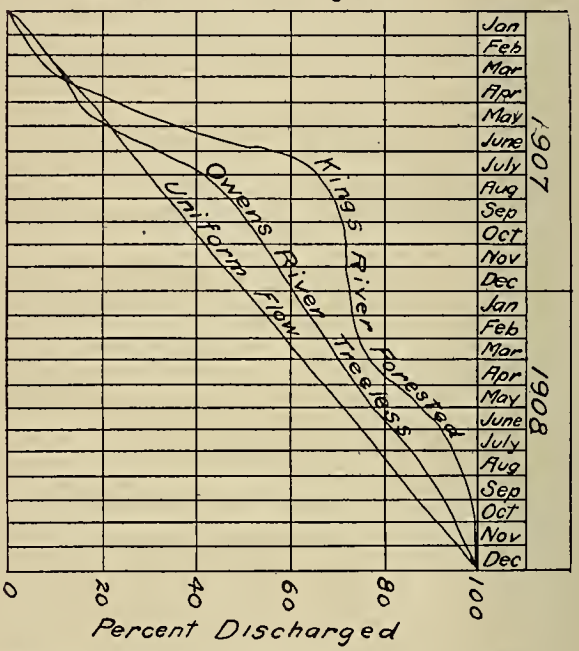
On the streams chosen, long records are not available, nor are they necessary. A comparison of simultaneous records for even one year are justifiable if the streams are subject to the same climatic influences.

The absolute values of runoff are of no moment in this inquiry, neither is a comparison of precipitation vital. To obtain a measure of uniformity of flow, a certain period has been selected, and the runoff for each month of that period has been expressed as a rainfall. Simultaneous records for 1909 have been added successively, giving a "mass curve" of monthly runoff.

Silvies and Blitzen Rivers lie in central Oregon. They flow from opposite directions into Malheur Lake. Both have about the some range of elevations. The topography is not unlike, and the soil and geologic structure are comparable. The Blitzen watershed has no trees at all, while the Silvies watershed is fairly well forested. Each receives about the same rainfall. Simultaneous records for 1902 have been used. The Blitzen River has a drainage area of 238 sq. miles, and discharged 77,100 acre ft. of water. Silvies River drains 450 sq. miles, and discharged 73,600 acre ft, in the same period.

Fig. 6 shows the uniformity characteristics of the two streams. If the flow was absolutely uniform, the curves would follow the straight line; that is, a constant percentage of the total flow would be discharged each month. The nearer the discharge curve follows and parallels this line, the more uniform is the flow. It is seen that Blitzen River without forests is very uniform, while Silvies discharged nearly all the water in the first six months of the year. (Where the curve is vertical, it indicates that nothing is being added to what has already passed.) Measured by our former standard of uniformity, i. e., the ratio of the minimum to the maximum, we find the uniformity factor for Blitzen River was .075, and of Silvies River .00079; that is, the uniformity of Blitzen River, without forests, is 100 times greater than the forested Silvies River. The principal reason for this lies in the fact that the Blitzen area is cut into gullies and canyons into which enormous quantities of snow are drifted each year. These melt gradually and keep up the flow. If the area were timbered, a great deal of this drifting would be prevented and it is not likely that so great a uniformity would obtain. Certain it is, the differences of soil and topography can never account for this great difference in flow. It is also seen that the yield per square mile of the Blitzen River is over twice that of the Silvies. The effect of dissipation





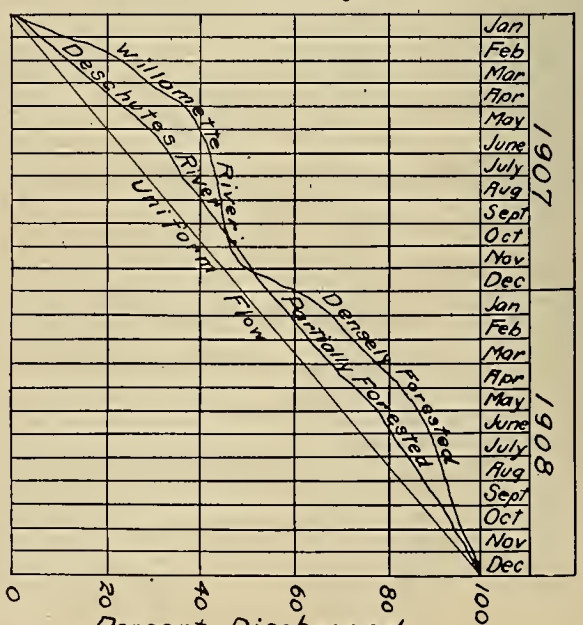


Fig. 6. Fig. 7. Fig. 8.
Giving "Mass Curves" of Monthly Runoff.

of water in this semi-arid region by forests is material in this case; however, it is doubtful if it will account for this difference in total yield.

I do not contend, by any means, that this difference in flow characteristics is accounted for by forest cover. It is due mainly to other causes. The effect of the trees in preventing snow drifts on Silvies watershed tends to decrease its uniformity of flow, but it is only a tendency, and I do not believe the absolute effect of this factor will account for more than 10 to 15 per cent of the difference in uniformity of flow.

Fig. 7 is a similar diagram for Kings and Owens rivers in California. Kings River drains 1740 square miles of densely forested mountainous country on the western slope of the Sierra Nevada Range. Owens River drains about 450 square miles of treeless country of the opposite side of the range. The general topographic and geologic features of the two regions are similar, although the Kings River watershed receives a great deal more precipitation in the year than does the Owens River Basin. The temperatures on the eastern side of the range are generally lower than those on the western.

Owens River is remarkably uniform in flow, as will be seen from the figure. The ratio of minimum to maximum during this period, 1907-8, which includes a high and a low year, was 0.146. Kings River, on the other hand, is subject to enormous floods and the minimum flow is comparatively low. Its ratio of minimum to maximum during the same period was only .0163. That is, the uniformity of Owens River is ten times that of Kings River.

This difference is decidedly unfavorable to the forest theory. However, we must look elsewhere for the explanation. The soil porosity and underlying rocks and the ruggedness of topography are similar on the two areas. The cause of the difference is found in the differences of temperature and precipitation. The flow of Owens River is maintained during the summer by huge snowdrifts that accumulate in the gullies and canyons of its area. The process of drifting is not interfered with by a forest cover. This interference, although a minor factor, is not immaterial.

We will next compare two forested watersheds. Willamette and Deschutes Rivers of Oregon, both flowing north, parallel to the Cascade Range; Willamette River drains 4860 square miles on the west, Deschutes River drains 9180 square miles on the east. The Willamette watershed is densely forested, while the Deschutes is only partially so. The topography of the area does not differ greatly, but the overlying soils are radically different.

Deschutes River is remarkably uniform in flow. Willamette River has no such distinction. The years 1907-8 include both a high- and a low-water year. The uniformity ratio of Deschutes River during this period was .180, while that of the Willamette was only .014, less than one-eighth as large. Fig. 8 shows the uniformity diagram for these streams, from which the wonderful uniformity in the flow of Deschutes River is apparent.

The difference in uniformity of flow of these streams is not due to forestry effects, for the less uniform stream has fully double the extent and density of forest cover. The cause is found in the soil cover and underlying rock structure. The Deschutes area is covered with a thick layer of porous pumiceous soil, presumably blown eastward by prevailing winds during the early periods of volcanic activity. Under this pumiceous cover lies the porous lava rocks. Together they provide such an abundant ground storage that the flow of Deschutes River scarcely varies from season to season. Whatever effect the forest has is to prevent soil absorption. The forest humus is less porous than the soil and therefore tends to prevent water from filtering into the soil. If we cover a pile of sand with fine dust, the dust acts as a shield to prevent infiltration.

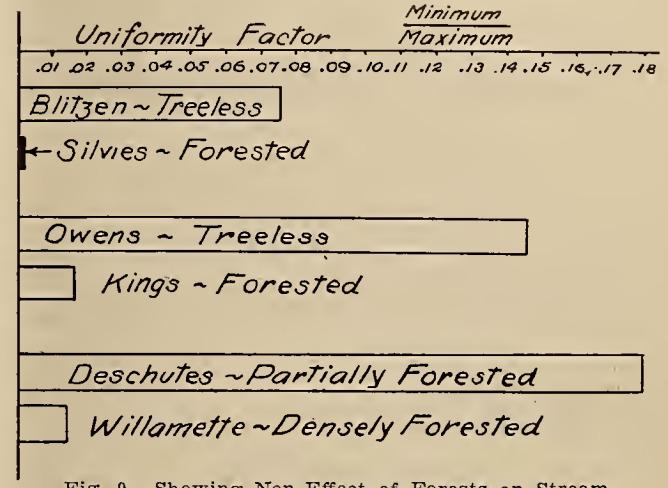


Fig. 9. Showing Non-Effect of Forests on Stream Flow.

On the Willamette watershed the soil is finer and more compact. The capacity for general storage is not nearly so great as on the Deschutes area. The forest cover, if it has any effect at all on this watershed, probably has a tendency to aid infiltration. This effect, however, is more than offset by the mechanical interference of the forests with snow drifting. The final result would probably be a slightly greater uniformity in both streams if the forests were removed. The difference, however, would be too slight to be of any importance.

The foregoing examples show conclusively that uniformity of stream flow is influenced, practically in total, by factors entirely independent of forests, and if forests have any influence at all on this feature, it is very insignificant. The tendency they do possess, though almost infinitesimal, would be in a helpful direction in some cases, in others in a harmful direction.

In order to sum up concretely the essential facts as brought out under this caption, I have prepared Fig. 9. The uniformity factors (ratio of minimum to maximum) for the examples cited, are shown to scale. Remembering that the larger this ratio, the more uniform the flow, the diagram needs no further explanation.

The latent heat of fusion of ice as determined from a most careful series of experiments of the U. S. Bureau of Standards is 79.63 calories per gram mass or 143.3 B.t.u. per pound mass.

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Visualizing Electricity

The real nature of electricity was the great unanswered riddle of the nineteenth century. The layman regarded it as an inexplicable mystery, the engineer was content to know the laws of its action and control, but the inquisitive scientist persisted in trying to discover its ultimate nature. So each year of the twentieth century has brought forth some discovery or some new idea which makes possible an ever bolder statement and an ever clearer mental picture as to what electricity is.

The several forms of radiant energy, electric waves, Hertzian waves, light rays and X-rays, have all been shown to be transversal wave motions transmitted through a hypothetical medium known as the ether. While the existence of this ether cannot be detected by the limitations of any of the five human senses, we have every reason to believe that it fills all space and permeates all matter.

Meanwhile the biologist has found that the form of any object is a diagram of forces, the shape of matter being due to the action of energy. The chemist found that matter is made up of extremely small particles known as molecules, which are in a continuous state of motion. These molecules are aggregates of two or more atoms, which in turn are largely made up of positive and negative electric charges known as ions or electrons, their number and their arrangement determining the kind of element.

Thus each infinitesimal atom may be imagined as a solar system which is held together by the mutual attraction of a central positive nucleus, and surrounding negative satellites. While the satellites revolve about the central sun the entire system has no velocity relative to the universe, of which it is an infinitesimal part. But there are negative electrons which, like comets, circulate from one system to another, thus establishing an exchange of energy between distant systems.

This electronic theory of energy assumes reality and gains in probability as it accounts for more and more new facts. It pictures matter as made up of fixed positive and neutral atoms and free negative electrons ready to respond to some accelerating force, and thus carry this energy to another system. While the negative electrons in an electric insulator, such as glass, do not respond to the accelerating action of electric force, they are affected by light waves, and thus act as carriers of light energy. On the other hand, the negative electrons of an electric conductor respond to an electric force, but not to light, and thus act as carriers of electric energy.

As this theory expresses matter in terms of electric charges, and the ether and as one form of energy can be changed into another, it should be possible to express electrical concepts in terms of mechanics, physics or chemistry, and so give a better understanding of electric phenomena in terms with which all are familiar.

Elsewhere in this issue W. F. Durand, Professor of Mechanical Engineering at Stanford University, by means of a beautiful physical explanation, identifies the heating effect in the conductor with the loss of energy by the free electrons. He shows that the rate

of work is proportional to their kinetic energy, that current flow is measured by their group momentum, and that all other specifications of an electric circuit can be expressed in terms of the number of electrons per unit area, the time during which they act, and the size and length of the conductor.

The engineer is more accustomed to thinking in these physical terms than in the mathematical abstractions by which electricity is usually expressed. Mathematics is a language which all cannot translate into English, and to the non-mathematician the mystery of electricity is still further dimmed by the obscurities of the calculus. Professor Durand's method is consequently a classic contribution to the great problem of visualizing electricity.

On Being a Joiner

Engineering and industrial societies are multiplying so rapidly that the surface appearance is that many must be unnecessary. That this is not so is borne out by the fact that each one arises in answer to a need, and is more directly the outgrowth of an age of specialization. Whenever one society alone has attempted to handle the technical, commercial, legal and other aspects of a particular line of endeavor, its work has become unwieldy.

But a comparatively short while ago, it was considered a sign of weakness to combine with others for mutual benefit in business. To be a "joiner" demonstrated lack of self reliance. Comparisons were then made between the sheep and the lion. You were weak to join, strong to stand alone. Views are now to the contrary.

Joint operation—working together for mutual benefit—is the keynote of the times.

In each society individual membership involves certain responsibilities. It is not only for what you will gain but for what you can give, that membership should be sought.

When asked to join any society one is apt to analyze the prospectus too closely for individual benefits of direct application. The general educational value of the work of a society both to the layman and professionals, will undoubtedly result in increased business. This may be due either to finding new outlets for trade or in raising standards of work so that better business obtains.

Active interest is most to be desired, but inability to attend meetings is not sufficient excuse for non-membership. Each should recognize that he owes practically everything to those pioneers and investigators who have gone before, and to those with whom he now labors, or, in a word, to his business.

Yet there are those who fail to recognize this debt, those who think themselves only responsible for the knowledge they possess. They desire to hoard it for personal privilege and private gain.

As a matter of fact, it belongs to all.

Each must do his part it is true, but the work you do contains nothing of isolation for into the lives of all men everywhere, has mounted up their debt to the past, and to contemporary thought and endeavor.

Realization of this fact would make the most pronounced egoist desirous of reaching out after opportunities to repay in degree their debt to that other part of existence so vaster than one's self.

Maurice Maeterlinck says of the bees, that they manifest a great common duty impartially distributed amongst them all and tending towards a future that goes farther and farther back ever since the world began. For the sake of the future, each bee renounces more than half of joy.

No such sacrifices are asked of the prospective "joiner," although it must be recognized that the increasing memberships possible, especially to electrical men, represents to the average individual an altogether too heavy financial burden.

What to join?

This question can perhaps be best answered by a reference to duty—duty to self, to one's fellows, to business, and to society at large, and its consideration may urge not only membership in additional societies, but a prompt renewal of those annual dues which have already been outstanding overly long.

Exposition Lighting 1915

Victor Hugo writes of French peasants who in a certain district were so poor that for artificial light, they burned resinous sticks and pieces of rope dipped in pitch. This was in 1815. The clock that ticks off the centuries has swung far over until it poises almost again at the starting point. The farmer of today uses the now common electric light.

But as in 1815 there were many systems of lighting in advance of the reeking and smoky burning rope, so there are now systems of lighting superior to those commonly used.

At the Panama-Pacific International Exposition at San Francisco, 1915, many of these will be in evidence.

From the former appeal of the "White City" to the moth instinct in man, a progressive appeal is now to be made to his sense of the esthetic. There will be no bright lights, but a symphony of color consequent upon scientifically applied light.

The capacity of visitors for seeing will be enhanced by this considerateness. The pain of burning eyeballs will not there tire, for even the "pyrotechnics" will be robbed of their intensely heated particles of high intrinsic brilliancy. Balls of fire will not burn their impress, like a branding iron, into the brain. Seeing will be as comfortable as modern travel.

Light playing upon smoke and steam, soap bubbles, and balls of cloth, will produce the more pleasing and more effective "fireworks."

But to say that there will be no brilliant light is not entirely correct, and savors of describing the diamond in terms of the moonstone, for thousands of jewels, more beautiful than the most magnificent gems, will scintillate bright rays of vari-colored lights from the outlined towers and buildings on which they are used.

Correct and spectacular high-pressure gas lighting will also be seen.

Those who have advocated outdoor indirect lighting will witness the achievement of this much to be desired end. The entire system will be what it should —an exposition of the utmost advance in the lighting art.

"There will be no night there neither sorrow nor sighing," for truly, the former things, have been done away.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

Chas. W. Barker, district engineer, Westinghouse Machine Company, is at San Francisco.

H. W. Beecher, manager Seattle office, Chas. C. Moore & Company Engineers, is a visitor at San Francisco.

W. H. Leffingwell, chief engineer, Mono Power Company, Bishop Creek, Cal., was in San Francisco this week.

F. L. Pratt, vice-president, Stone & Webster Corporation, Boston, Mass., was at Seattle during the past week.

C. H. Holley, secretary and manager, Tulare County Power Company, Lindsay, Cal.. was at San Francisco last week.

Henry E. Harris, of the Harris Ice Machine Company, Portland, Oregon, was a recent visitor at San Francisco.

Bassett Jones Jr., electrical and illuminating engineer, is now associated with the H. W. Johns-Manville Company.

W. P. Ballard, superintendent Visalia Electric Railway, Exeter, Cal., was a visitor at San Francisco during the past week.

J. W. Thompson, salesman, electrical department, H. W. Johns-Manville Company, has returned to San Francisco from New York.

H. L. Jackman, manager, Western States Gas & Electric Company, was at San Francisco from Eureka during the past week.

E. N. Sanderson, of Sanderson & Porter, consulting engineers, is now at Tucson, Arizona, and expected at San Francisco shortly.

Armond P. Marion, civil engineer, announces the removal of his offices from 312 Hoge Building, Seattle, to 314 Mehlhorn Building.

Geo. A. Boomer, Pacific Coast representative, Plume & Atwood Manufacturing Company, is on a business trip through the Pacific Northwest.

H. B. Hall, Pacific Coast manager, Pass & Seymour, Inc., has returned to San Francisco from a business trip made throughout the Pacific Northwest.

W. J. C. Wakefield has been elected chairman of the executive committee of the Washington Water Power Company, Spokane, Wash., to succeed the late Henry M. Richards.

W. L. Overman, representative of the Hughes Electric Heating Company, is in Salt Lake City completing arrangements for handling their line of electric ranges in that territory.

George P. Trayner has resigned his position in the commercial department of the Utah Light & Railway Company and has gone on the road for the Lambert Paper Company of Salt Lake City.

H. L. Garbutt, head of the railway line material division, Westinghouse Electric & Manufacturing Company, is at San Francisco and will visit other western offices of the company in the interests of his department.

W. J. Grambs, assistant to the president, Puget Sound Traction, Light & Power Company, was a recent visitor at Portland, Oregon. Mr. Grambs was recently elected treasurer of the Employers' Association of Washington.

W. D. Thomas, of Petaluma, Cal., has disposed of his interests in the electrical contracting business which will now be carried on by Bauer & Baugh, the purchasers. Mr. Thomas will engage in the automobile supply business at Fresno, Cal.

T. L. Bissell has resigned his position in the commercial department of the Utah Light & Railway Company and has taken the agency for several lines of contractors' machinery for the state of Ohio, has returned to the East to take up this line of work.

R. Vance Pearson has been appointed to represent the Utah Light & Railway Company in the commercial field at Ogden, Utah. Mr. Pearson has been connected with the electric line and service department of the above named company for the past ten years, in Salt Lake City and Ogden, Utah.

Paul Lebenbaum, electrical engineer, Portland, Eugene & Eastern Railroad, will speak on the electrification of that company's line, at the next joint meeting of the Portland Sections A. I. E. E., and N. E. L. A., at the Hawthorne Building, Portland, Oregon, March 3d.

S. T. Whitaker, local manager Utah Light & Railway Company, Ogden, has just returned from a two weeks' trip to California points. While the main objects of his journey were rest and recreation, Mr. Whitaker spent considerable time looking into matters pertaining to the electric light, power and gas business.

W. E. Blodgett, assistant secretary of the Utah Light & Railway Company, has returned from a trip to Los Angeles and San Francisco. He took occasion while there to investigate the progress in the lighting, power and street railway development, and was particularly impressed with the rural distribution systems there and the high voltage of the main transmission lines.

W. C. Wurfdel, district manager Westinghouse Lamp Company, Salt Lake City, presided at a get-together banquet held at the Commercial Club last week, at which twenty-two members of the local sales organization were present. **Walter Albertson**, of the Denver office of the company, and **L. Wood Davis**, covering the Butte and Spokane territory, were also in attendance.

John H. Lewis, state engineer, Oregon, has announced his candidacy for re-election. He was appointed to his present position by Governor Chamberlain when the office was created in 1905. His office has to do with the water resources of the state, and he conducts waterpower and other surveys in co-operation with the United States. He first suggested co-operation between the state and Nation in the construction of reclamation works in 1912, which plan is now being favorably considered by a number of states. Lewis was recently appointed by the American Society of Civil Engineers on a committee to prepare a national water law.

Edward M. Cheney, electrical engineer, Washington Surveying and Rating Bureau, 459 Colman Building, Seattle, Wash., has been elected an Associate Member of the American Institute of Electrical Engineers. The following have also been elected associates: **Wm. D. Cleveland**, superintendent telephone and telegraph, Oregon Electric Railway, Portland, Oregon; **Jas. G. M. Connolly**, electrician, Western Canada Power Company, Vancouver, B. C.; **E. A. Haggan**, editor, Mining, Engineering and Electrical Record, Vancouver, B. C.; **George H. Kohl**, electrical engineer, Ritchie, Agnew & Company, Prince Rupert, B. C.; **C. D. Lamoree**, sales engineer, Westinghouse Electric & Manufacturing Company, Los Angeles, Cal.; **Carl C. Long**, station superintendent, Utah Power & Light Company, Grace, Idaho; **Alfred Trott**, erecting department, Canadian Westinghouse Company, Vancouver, B. C., and **Albert L. Walker**, assistant resident engineer, Grand Trunk Pacific Railway Company, Dry Dock, Prince Rupert, B. C.

MEETING NOTICES.

Pacific Coast Jobbers' Association.

The next convention will be held at Del Monte, Cal., on March 5, 6 and 7, 1914. A large and representative attendance is anticipated and a comprehensive program will be carried out.

Pacific Coast Gas Association Convention.

The 22d annual convention of this association will be held at Long Beach, California, from September 16 to 18, 1914, both dates inclusive. Some excellent papers are already re-

ceiving consideration at the hands of the authors and will prove of benefit and industry to the gas fraternity. It will pay to plan ahead to be there.

Utah Society of Engineers.

L. C. Howard, a Salt Lake mining engineer, and editor of the Salt Lake Mining Review, gave a talk at the regular meeting of the Utah Society of Engineers, on February 20th, on "The Development of Utah Radium Bearing Ores."

San Francisco Electrical Development and Jovian League.

"With the Movies Through the Panama Canal," constituted a good drawing card at the regular weekly meeting of the league. Mr. E. H. Kemp made the photographic tour for the government and told, informally, much of interest in connection with the great work. The pictures also were excellent.

Portland Electrical League Luncheon.

The regular luncheon of the Electrical League of Portland, Oregon, was held at 12:15 p. m., Wednesday, February 18th. Motion pictures of the Assouan dam in Egypt were shown. The Assouan dam is the largest dam and one of the greatest engineering projects in the world. It extends across the Nile River 700 miles above its mouth, and is 6400 ft. long. The cost of the dam was $24,000,000. The dam creates a storage reservoir 143 miles long from the flood waters of the Nile. This water is used for irrigating purposes during the dry season.

Also a film was shown depicting the new oxy-acetylene flame in action cutting steel bars.

The luncheon was attended by over 100 electrical men and their friends and pronounced a great success by every one present. Burnett Goodwin of the Northwestern Eectric Company acted as chairman. The next luncheon will be on Wednesday, March 4th, at the Multnomah Hotel.

Cleveland Electrical Exposition.

Cleveland is planning a great electrical exposition to be held May 20 to 30 in the Coliseum. The project is to be given under the auspices of the Electrical League of Cleveland whose committees have been so active during the first month of preparation that success is already assured. The Sixth City claims to lead the nation in many departments of the electrical trade. It is the headquarters for the greatest lamp works, the home of the biggest carbon manufacturing plant, and it boasts of three leading manufacturers of electric vehicles. It holds highest rank in the manufacture of electric cranes and hoisting machinery and is a leader in the making of batteries. It claims many of the largest electrical machinery plants, and its public service company is said to be a model of progress and efficiency.

Applications for space have come so swiftly that three weeks from the date of the launching of the project, one-half of the total floor area was sold.

For its decorating and lighting scheme the committee has the services of a corps of leading electrical engineers. This is to be the first electrical exposition ever held in Cleveland, and the city is planning to give it in the same manner that characterized its Industrial Exposition which was acknowledged to be the largest and most successful ever held in this country.

Utah Electric Club.

At the regular weekly luncheon of the Utah Electric Club held February 19th, Dr. A. A. Knowlton, Professor of Physics at the University of Utah, spoke on "The Electrical Method of Smoke Prevention." He illustrated with a small experimental model of the Cottrell system of smoke deposition which is now being applied to two of the large smelters in Salt Lake valley, and which offers to afford a fairly satisfactory solution of the problem of smoke prevention as applied to large stacks. According to his observations, much of the smoke here in Salt Lake City in the residential portion is caused by the smoke from the small stacks of residences and apartment houses in that section.

As a member of the club Dr. Knowlton offered a resolution providing that the Electric Club recommend to the commission of Salt Lake City that they employ a corps of experts to be headed by the best authority on the subject to be found in the country, to study the smoke problem as it affects this city, which resolution was unanimously adopted.

Ex-Governor Heber M. Wells, who is now Commissioner of Parks and Public Property, was present and expressed himself as favoring this move. Mr. Wells was largely responsible for the recent smoke prevention ordinances passed by the city commission. He stated that the commission had studied the ordinances with reference to this subject in all of the principal cities of the country, and after careful consideration, had adopted one patterned after the ordinance now in effect in Chicago, which seems to meet the conditions existing here as nearly as one could be drawn.

TRADE NOTES.

The Holophane Works of General Electric Company announces a new district office in the Frisco Building, St. Louis, Mo. J. G. Barrett will be in charge of this office, with R. H. Lyon as his assistant. The Chicago district office has been transferred from 425 So. Wabash avenue to room 715 Mallers building. John W. Foster is manager of sales in the Chicago district. R. E. Perry, who has handled Holophane sales in the Cleveland district, has been transferred to the Chicago district with headquarters at Minneapolis.

A 200 h.p. steam plant on Andrus Island in the Sacramento River near Walnut Grove, California, was put out of commission when the Island was flooded on January 29th. On January 30th it was decided to put in a 150 h.p. electric driven unit to take its place. It was absolutely necessary to have this plant operating at once, as several families on the Island were in great danger. By February 2d the Great Western Power Company had set twenty-four poles, and W. S. Heger Jr. had installed a motor, and finished the connections, so that the pumps were in operation that evening. The motor was supplied by the General Electric Company, who had it en route three hours after the order was placed, and the special pulleys necessary to convert the direct driven steam unit into a belt driven electric unit, were designed, built and shipped by Meese, Gottfried Company within three days.

NEW CATALOGUES.

The Simplex Manual issued by the Simplex Wire & Cable Company in a handy pocket size, contains, in addition to information regarding Simplex products, tables and data for ready reference and will be found invaluable to electrical engineers, contractors, wiremen and others.

A door safety switch is described in a bulletin just issued by the Cutler-Hammer Company, Milwaukee, Wis. A great majority of accidents occurring on all types of elevators are the result of setting the elevator in motion before the doors are locked. This bulletin shows how such accidents and others incidental to elevator operation may be avoided.

The Westinghouse Electric and Manufacturing Company has just issued Folder 4237, "The Way to Charge Three Cells." It describes the Westinghouse mechanical vibrating rectifier for charging small storage batteries used for ignition and lighting sets on automobiles. Westinghouse Electric Vehicle Equipment, Section 3223, shows a number of illustrations, together with detailed description of the construction of the electric motor and its application. Curves are also given showing the performance of 60 and 80-volt motors. Section DS1410 covering direct-curent switchboard panels for 100 and 220-volt systems. Section DS842 of the Trolley Line Material Catalogue lists and describes various bracket arms for direct and catenary construction.

NEWS NOTES

INCORPORATIONS.

SAN FRANCISCO, CAL.—Rex Electric & Construction Company, $25,000, shares $1 each, subscribed $3, by A. E. Needham, W. W. Perry and E. R. Eliassen.

BLAINE, WASH.—Blaine, Lynden Electric Company has organized with a capital stock of $250,000. The purpose is to build an interurban road between Blaine and Lynden. The officers are John J. Pinckney, president; Lester Livingston, secretary, and James A. Willson, treasurer, all of Blaine.

THREE FORKS, MONT.—The Farmers' Home Telephone Company has filed articles of incorporation for the purpose of constructing, purchasing, leasing, operating and maintaining telephone exchanges in parts of Gallatin, Broadwater and Jefferson counties. G. C. Watson, V. Lund Jr., R. S. Dutcher, R. R. Young and J. A. Gastineau are directors.

ILLUMINATION.

ARCADIA, CAL.—Bids will be received up to April 4th for an electric franchise upon streets in this city.

BELLINGHAM, WASH.—Mayor J. P. de Mattos in special message to council recommended bonding of the city for $400,000 to build a municipal lighting plant.

RIVERBANK, CAL.—The supervisors have granted a franchise to the Oakdale Gas Company to lay gas pipes and conduits from Oakdale to Riverbank.

GLOBE, ARIZ.—Petitions are to be circulated in a short time to secure signers in favor of a bond election for construction of a municipal electric light plant.

ST. HELENA, CAL.—Sealed bids will be received up to March 10th for installing thirty-seven 3-light electroliers on Main street between Sulphur Spring Creek and York Creek.

HELENA, MONT.—Citizens of the west side have decided to petition the council for a lighting system similar to one now in use on the east side. Mayor Purcell is in favor of the petition and the council will take action in the matter soon.

SNOHOMISH, WASH.—A representative of a large corporation has been in conference with Mayor Watson regarding the possibilities of granting a second franchise for the privilege of erecting poles and wires and furnishing electric light and power in this city.

RIALTO, CAL.—Sealed bids will be received up to April 7th, by the board of trustees for franchise, granting right to construct and operate for a period of 59 years, an electric pole and wire system for transmitting electrical energy along streets in this city. The franchise has been applied for by the Rialto Light, Power & Water Company.

VANCOUVER, B. C.—For stealing current for about one year from the lines of the British Columbia Electric Railway Company, a former electrician, now a cattle dealer in the Collingwood district, was sentenced by Judge McInnes to a six months' term in jail with the option of a $500 fine and was required, in addition, to pay an estimated bill for current taken, of $241.

BOISE, IDAHO.—Pursuant to the provisions of that portion of the public utility act passed at the 1912-13 session of the Idaho state legislature, regarding the rates for electric light and power service throughout Idaho, the Utah Power & Light Company has filed with the public utilities commission of the state a new and uniform schedule of rates for all service furnished by the company to its Idaho customers. The new schedule will go into effect about March 1st, throughout all of the territory served in Idaho by the Utah Power & Light Company.

TRANSMISSION.

TUCSON, ARIZ.—That it is commercially feasible to build a dam in Grand Canyon of Arizona and supply cheap power throughout the state has been determined by Col. Espes Randolph, president of Randolph lines. He and his associates, Ralph H. Cameron of Phoenix and Eugene S. Ives of Tucson, are looking into their legal rights. The project would cost about $44,000,000, possibly $50,000,000.

TRANSPORTATION.

PRESCOTT, ARIZ.—The Winslow city council has voted a franchise to J. F. Mahoney to construct and operate an electric street car system.

SAN FRANCISCO, CAL.—The board of public works has given notice of a call for bids to be opened on May 4th for building the Chestnut street branch of the Municipal Street Railway system from Van Ness avenue along the Exposition grounds. This will be the first portion of the extension to be built under the recent bond issue.

SAN FRANCISCO, CAL.—The proposed construction of part of a new municipal railway line on Second avenue, between Geary and Cornwall streets, should be carried out, the city engineer has advised the supervisors, notwithstanding the protest of owners of property on the avenue, who claimed that the roadway was too narrow for a railway.

PORTLAND, .ORE.—The Sandy Commercial Club has been informed that the franchise to construct a single track railway from Boring to Sandy has been granted by the Clackamas County Court to the Clackamas County Development Company. The power will be gasoline to start with but later it is expected that it will be electricity. The promoters say that they will build the line at once.

OAKLAND, CAL.—The San Ramon Valley Electric Railroad, a feeder of the Oakland, Antioch & Eastern, recently constructed at a cost of $300,000, will open for passenger and freight business March 1st. The new road joins the main line of the Oakland & Antioch one mile west of Walnut Creek and extends 11 miles southward tapping the farming districts of Danville and Alamo and extending to the foot of Mt. Diablo near the center of the Cook ranch.

BUTTE, MONT.—Butte Street Railway Company has filed a petition asking for a franchise for the construction of a line to run east on Dewey street and south on Paxton street to Cleveland street, distance of three-quarters of a mile. The estimated cost is $10,000. The construction is to be paid for by the Butte Improvement Company, incorporated by H. E. Hickey, president; H. A. Frank, secretary and treasurer; E. M. Frank, vice-president. If the franchise is granted light and telephone wires will be extended to the district.

OAKLAND, CAL.—The first elevated railway in this vicinity was opened for use last week when the Berkeley electric trains of the Southern Pacific Company were run over the elevated tracks at the Sixteenth street station. The road cost nearly $500,000 and is entirely of steel and piling. The new elevated structure is used by trains of the Shattuck avenue, Ellsworth avenue, California street loop and Ninth street loop. The new structure is about a mile long, running from Ninth to Twentieth streets. It is double tracked and rock ballasted.

SALT LAKE CITY, UTAH.—The Utah Light & Railway Company, announces that the extension of the Holliday street railway line from its present terminus approximately ten miles southeast from the center of the city through to the company's lower power house in Cottonwood Canyon, a dis-

tance of approximately five miles will be built. The Big Cottonwood Canyon is one of the most picturesque of Utah's canyons and has long been popular as a summer camping place. It has not been readily accessible to tourists heretofore, except by automobile stages, and this extension should develop a large amount of traffic there, both in summer and winter.

SAN FRANCISCO, CAL.—The Ocean Shore Railroad will probably be operated by electricity within a few months. Land operators and investors have pledged themselves to take a large share of the $200,000 bond issue for which the Ocean Shore has made application. With this money, according to the railroad officials, the steam trains can be supplanted by modern electric cars run over a single track route with a sufficient number of sidings, as far as Half Moon Bay, the present terminal. It is estimated on the basis of last year's business that the Ocean Shore, if it had been operated by electricity instead of steam, would have shown earnings of from $25,000 to $30,000.

SACRAMENTO, CAL.—The judgment of the Yolo County Court in allowing the condemnation by the Vallejo & Northern Railroad of 1041 acres of land with a river frontage of 2500 ft. of the Reed Orchard Company lying on the Yolo bank of the Sacramento River, between M and T streets for wharfage purposes, at the price of $104,100, is reversed in a decision handed down by the appellate court. The opinion, written by Justice Burnett and concurred in by Justices Chipman and Hart, also denied the request of the railroad that the appeal of the Reed Orchard Company be dismissed. The long litigation over the river frontage is thrown back into the courts for another trial, with the question again to be determined of the right of the company to condemn this amount of land and the price that should be paid. A new trial will have to be heard in the Yolo county court.

SAUSALITO, CAL.—All opposition in the board of trustees to Sausalito's two proposed street railways was swept aside at a meeting of the council this week and the franchises were passed to print without a dissenting vote. The Marin County Electric Railways Company proposed to connect this city with Mill Valley and way stations, as well as to give both towns a street car service. The other application is that of Dr. A. H. Vance and Attorney George Harlan, representing San Francisco capitalists, for a right of way along Excelsior lane for funicular railway purposes. The Marin Electric Railways Company has secured its Mill Valley and county franchises. The funicular railway company proposes to build and operate a railway similar to that of the Fairfax Manor Company in Fairfax, making available for residence a large part of the hill section of Sausalito that is not marketable under the present conditions. The road will be about a quarter of a mile long at the outset, and will attain an elevation of about 450 ft.

TELEPHONE AND TELEGRAPH.

LOS ANGELES, CAL.—An ordinance has been passed creating a bureau of fire alarm and police telegraph in the department of electricity.

SALEM, ORE.—The state railroad commission has granted a request of the Aurora Mutual Telephone Company to increase its rates from 75 cents a month to $1.25 on each telephone.

PACIFIC, WASH.—A number of farmers have organized between here and Sumner to install a farmers' telephone system. They have been granted a franchise by the Pierce county commissioners.

FLAGSTAFF, ARIZ.—District Manager R. H. Buehler of the Mountain States Telephone Company, states that material for a telephone system is being assembled here and work will soon commence.

CENTRALIA, WASH.—The commissioners of Lewis county will meet March 2d to hear the application of the Bunker Creek Rural Telephone Company, and Mary E. Coffman for authority to erect telegraph and telephone lines over the Robert Mauermann Road, Stearns or Bunker Creek Road, Blake or Deep Creek Road, J. E. Bunker Road and Math. Kobe Road. They will also on the same day hear the application of the Crego Telephone Company for authority to construct telephone and telegraph lines over the Newukum and Boistfort Road, Chas. A. Cousens Road, Christ Frogner Road, J. Bona Road and others.

SAN FRANCISCO, CAL.—Consideration of telephone rates was begun a few days ago by the supervisors' committee having this work in charge. In its statement the company points out that the rates have been reduced every year for the last five years and have reached a point that it is not paying a return upon the investment, and it asks to be allowed to make at least 8 per cent. The company says that the net revenue allowed by last year's rates amounted to $300,976, and that this is only 1.82 per cent return on the investment. The company asks that this be substantially increased this year. The company has 111,165 telephones in this city or 23.3 telephones to every 100 inhabitants, and it says that large additions will be required to this system between now and the time of the opening of the Exposition. While the rates have been cut 24.9 per cent, the company says the expenses have not decreased in proportion, and only show a reduction of 10.1 per cent. The payroll of the company is said to be $2,766,294 a year.

WATERWORKS.

PENDLETON, ORE.—Pendleton will vote in the near future on a $40,000 bond issue for the construction of a gravity water system.

EL CENTRO, CAL.—An ordinance has been passed providing for the issuance and sale of bonds in the sum of $50,000 for the purpose of acquiring and constructing a water system here.

SNOQUALMIE, WASH.—An ordinance has been passed providing for the construction and maintenance of a system of waterworks in this town and providing for a bond issue to pay for same.

MONTAGUE, CAL.—Sealed bids will be received up to March 23d on the proposals in connection with the construction of the municipal water system. Segregated bids will be received for different parts of the work.

LOS ANGELES, CAL.—The board of supervisors of Los Angeles county have granted to the Eagle Rock Water Company a franchise to lay, construct and maintain certain water pipes along certain public highways in this city.

MARTINEZ, CAL.—The gas franchise as applied for by Waldo Coleman came up for definite action at the last meeting of the municipal board and was ordered to be advertised for sale to the highest bidder on March 23d.

SAN DIEGO, CAL.—Plans for beginning early construction improvements to the water impounding system are being formed by Engineer H. A. Whitney, as fast as he can assemble data and conduct experiments at Barrett and in Mission valley.

PULLMAN, WASH.—It is proposed to bond the city for $20,000 for the construction of a water system. A new 10 in. main will have to be laid from the new well to the intersection of Main and Alder streets, and it is proposed to erect a 60,000 gallon elevated tank near Kincaid's.

ROSEBURG, ORE.—Councilman J. C. Fullerton introduced a resolution before the council providing for the appointment of a commission of five members not of the city council, to proceed with the investigation of the cost of installing a municipal water system in this city.

ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page opposite

A-1 American Ever-Ready Co.....
Los Angeles; 755 Folsom Street, San Francisco; Seattle.

B-1 Benjamin Electric Manufacturing Co.....
Rialto Building, San Francisco.

B-2 Berkeley Electric Cooker Co.....
1932 Center Street, Berkeley.

B-3 Blake Signal and Manufacturing Co.....
680 Howard Street, San Francisco.

B-5 Bridgeport Brass Co..... 4
(See Pierson, Roeding & Co.)

C-1 Century Electric Co..... 3
614 So. Grand Ave., Los Angeles; Salt Lake City; 56 Natoma Street, San Francisco; Seattle; Spokane.

C-2 Crocker-Wheeler Co.....13
Title Insurance Bldg., Los Angeles; Salt Lake City; First National Bank Bldg., San Francisco; Seattle.

C-3 Cutler-Hammer Manufacturing Co.....12
579 Howard Street, San Francisco; Morgan Bldg., Portland, Ore.; San Fernando Bldg., Los Angeles.

D-1 D. & W. Fuse Co.....
(All Jobbers.)

D-2 Dearborn Drug and Chemical Works 13
355 East Second Street, Los Angeles; 301 Front Street, San Francisco.

E-1 Edison Lamp Works of General Electric Co.....
(See General Electric Company.)

E-2 Edison Storage Battery Supply Co.....13
441 Golden Gate Avenue, San Francisco.

E-3 Electric Agencies Co.....
247 Minna Street, San Francisco.

E-4 Electric Storage Battery Co.....
Pacific Electric Building, Los Angeles; Spalding Building, Portland; 118 New Montgomery Street, San Francisco; Colman Building, Seattle; Pacific Building, Vancouver.

F-1 Fairbanks, Morse & Co.....
Los Angeles; Portland; 651 Mission Street, San Francisco; Seattle; Spokane.

F-2 Fort Wayne Electric Works of G. E. Co..... 5
Rialto Building, San Francisco; Colman Building, Seattle.

G-1 General Electric Co..... 15-16-17
124 W. Fourth Street, Los Angeles; Worcester Building, Portland; Rialto Building, San Francisco; Colman Building, Seattle; Paulsen Building, Spokane.

H-1 Habirshaw Wire Co.....
(See Western Electric Company.)

H-2 Hemingray Glass Co.....13
330 So. L. A. Street, Los Angeles; 345 Oak Street, Portland; 807 Mission Street, San Francisco.

H-3 Hoagland-Hulse Electric Co.....
1707 Naud Street, Los Angeles.

H-4 Hunt, Mirk & Co.....
141 Second Street, San Francisco.

I-1 Indiana Rubber and Insulated Wire Co.....18
807 Mission Street, San Francisco.

K-1 Kellogg Switchboard and Supply Co.....
Aronson Building, San Francisco.

K-2 Keystone Boiler Works.....
201 Folsom Street, San Francisco

K-3 Klein & Sons, Mathias..... 4
579 Howard Street, San Francisco.

K-4 K-P-F Electric Co.....
37 Stevenson Street, San Francisco.

L-1 Leahy Manufacturing Co.....13
Eighth and Alameda Streets, Los Angeles.

L-2 Locke Insulator Manufacturing Co..... 4
(See Pierson, Roeding & Co.)

M-1 Mannesmannrohren-Werke .....
Rialto Building, San Francisco.

M-2 McGlauflin Manufacturing Co..... 4
Sunnyvale.

M-3 Moore & Co., Charles C.....
Van Nuys Building, Los Angeles; Spalding Building, Portland; Kearns Building, Salt Lake City; 40 First Street, San Francisco; Mutual Life Building, Seattle; Santa Rita Hotel Building, Tucson.

N-1 Nason & Co., R. N.....
151 Potrero Avenue, San Francisco.

N-2 National Conduit & Cable Co., The.....
Trust and Savings Building, Los Angeles; Rialto Building, San Francisco.

N-3 National Lamp Works of G. E. Co.....
(All Jobbers.)

N-4 New York Insulated Wire Co.....
629 Howard Street, San Francisco.

N-5 Norris Co., L. A. .....
Monadnock Building, San Francisco.

O-1 Okonite Co. 18
(All Jobbers.)

P-1 Pacific Electric Manufacturing Co.....
80 Tehama Street, San Francisco.

P-2 Pacific States Electric Co..... 2
526 So. L. A. Street, Los Angeles; 90 Seventh Street, Portland; 526 Thirteenth Street, Oakland; 575 Mission Street, San Francisco; 307 First Ave., So., Seattle.

P-3 Parker Boiler Co.....
201 Folsom Street, San Francisco.

P-4 Pelton Water Wheel Co.....13
2219 Harrison Street, San Francisco.

P-5 Pierson, Roeding & Co..... 4
Pacific Electric Building, Los Angeles; Spalding Building, Portland; Rialto Building, San Francisco; Colman Building, Seattle; Pacific Building, Vancouver.

P-7 Pittsburg Piping & Equipment Co.....18
Monadnock Building, San Francisco.

S-1 Schaw-Batcher Company, Pipe Works, The.....
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S-2 Simonds Machinery Co.....
12 Natoma Street, San Francisco.

S-3 Simplex Electric Heating Co.....13
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S-4 Southern Pacific Co..... 11-13
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S-5 Sprague Electric Works of G. E. Co..... 3
Rialto Building, San Francisco; Colman Building, Seattle.

S-6 Standard Underground Cable Co.....
First National Bank Bldg., San Francisco; Hibernian Bldg., Los Angeles; Yeon Bldg., Portland, Or.; Central Bldg., Seattle, Wash.

S-7 Staples & Pfeiffer.....
102 Steuart Street, San Francisco.

T-1 Thomas & Co., R.....
(See Western Electric Co.)

V-1 Van Emon Elevator Co.....
56 Natoma Street, San Francisco.

W-1 Wagner Electric Manufacturing Co.....13
Rialto Building, San Francisco.

W-2 Western Electric Co.....18
119 East Seventh Street, Los Angeles; 507 Sixteenth Street, Oakland; 680 Folsom Street, San Francisco; 1518 First Avenue, So., Seattle.

W-3 Westinghouse-Church-Kerr Co.....
Pacific Electric Building, Los Angeles; Pacific Building, San Francisco.

W-4 Westinghouse Electric and Manufacturing Co..... 6
50-52 East Broadway, Butte; Van Nuys Building, Los Angeles; Couch Building, Portland; 212 So. W. Temple, Salt Lake City; 165 Second Street, San Francisco; Central Building, Seattle; Paulsen Building, Spokane.

W-5 Westinghouse Machine Co.....
141 Second Street, San Francisco.

W-6 Westinghouse Lamp Co.....
(See Westinghouse Electric and Manufacturing Co.)

W-7 Weston Electrical Instrument Co..... 3
682 Mission Street, San Francisco.

W-8 Western Pipe & Steel Co.....
444 Market Street, San Francisco; 1758 North Broadway, Los Angeles.

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the act of Congress March 3, 1879.

VOL. XXXII NO. 10 SAN FRANCISCO, MARCH 7, 1914 PER COPY, 25 CENTS

ELEMENTS OF FUEL OIL PRACTICE AND BOILER TESTING.

BY ROBERT SIBLEY.

STANDARD SPECIFICATIONS FOR POLES.

PUBLIC POLICY OF PUBLIC UTILITY CORPORATIONS.

BY S. WALDO COLEMAN.

DISCUSSION ON WATER POWER BILL.

BY A. E. CHANDLER, W. A. COOPER, H. T. JONES, JOHN S. EASTWOOD AND RUSSELL L. DUNN.

MATERIALS ADVERTISED IN THIS ISSUE

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Electric Storage Battery Co.

Boiler Feed Water Treatmeut
Dearborn Chemical Co.

Boxes and Fittings
Sprague Electric Works

Conduit
Pierson, Roeding & Co.

Electrical Instruments
Weston Electrical Instrument Co.

Fans
Pacific States Electric Co.

Heating Appliances
Simplex Electric Heating Co.

Insulators
Hemingray Glass Co.
Pierson, Roeding & Co.
Western Electric Co.

Motors
Century Electric Co.
Crocker-Wheeler Co.

Piping
Pittsburgh Piping & Equipment Co.
The Shaw-Batcher Co.

Reflectors
Holophane Works

Subway Boxes
D. & W. Fuse Co.

Switches
Pacific Electric Mfg. Co.

Telepbones
Kellogg Swtichboard & Supply Co.

Tools
M. Klein & Sons

Transformers
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Southern Pacific Co.

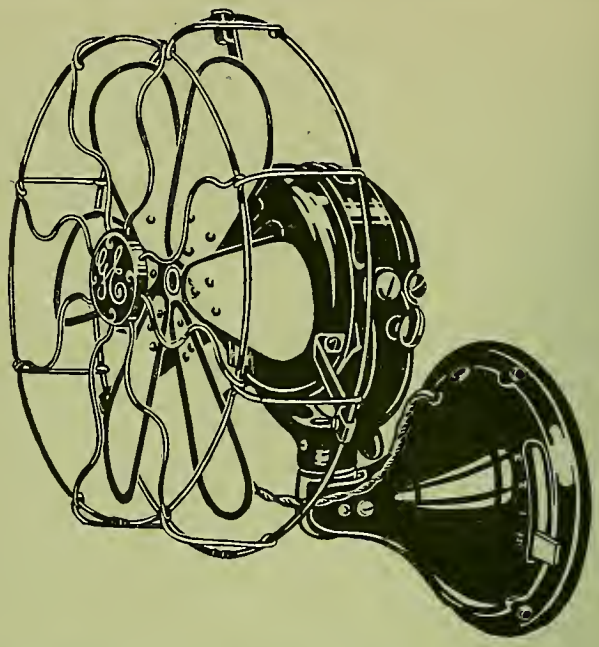
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Sprague Electric Co.
Standard Underground Cable Co.
Western Electric Co.
Wagner Electric Co.

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ELEMENTS OF FUEL OIL PRACTICE AND BOILER TESTING

BY ROBERT SIBLEY.

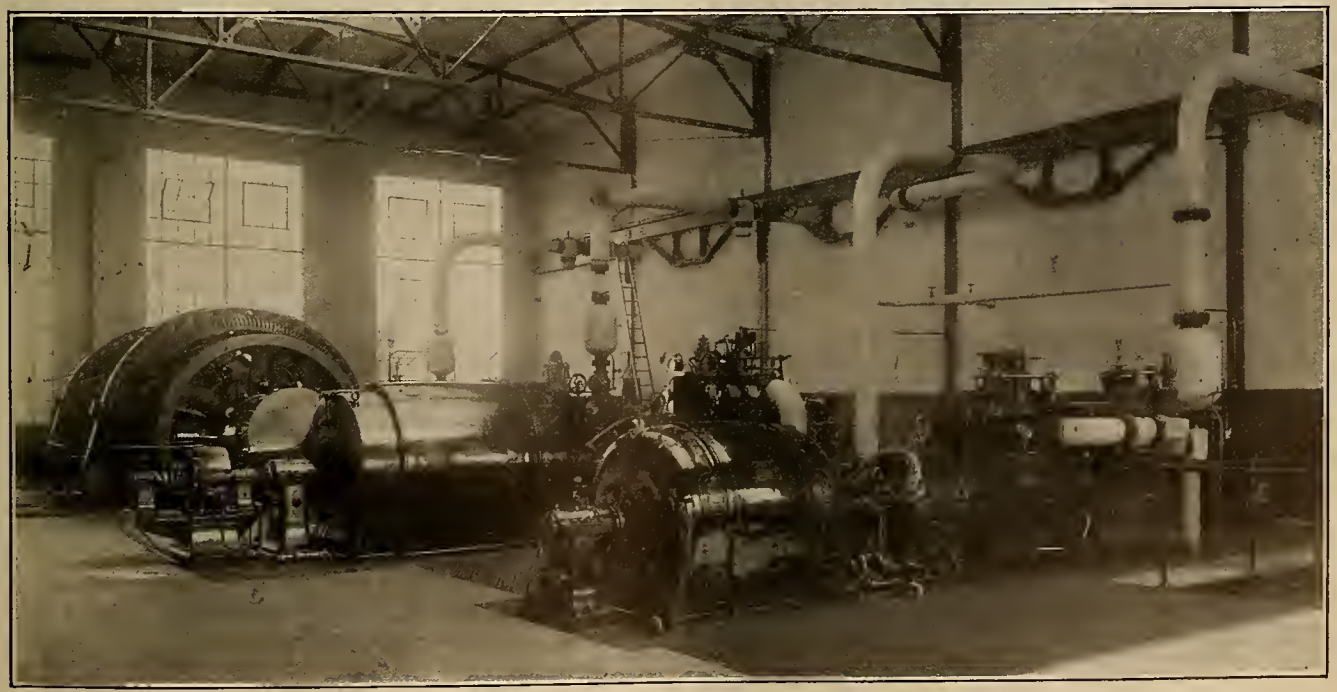
(This is the first of a series of articles which in their entirety will constitute a complete treatise on steam power plant practice. The author is Professor of Mechanical Engineering at University of California.—The Editors.)

The Modern Power Plant and the Reason for Its Existence.



The enormous growth of the electrical industry throughout the world during the past decade has entirely revolutionized methods of power development. Especially is this true west of the Rocky Mountains where gigantic natural water powers have been put to a useful purpose. Owing to the fact, however, that most of the western streams show a great variation in flow, in the different seasons of to depend solely upon water power the year, it is not always possible for the supply of electrical energy. In recent years the advent of crude petroleum upon the Pacific Coast, representing a total in production of 98,000,000 barrels during the year 1913, has made it possible when rainfall or water supply is lacking to cheaply supply the needed power. During certain hours of the day, too, when the so-called peak load conditions are to be met by a central station, additional powers over that possible to supply from the hydroelectric station are found to be necessary. Hence the steam power plant, consisting of large concentrated units, is now recognized as an indispensable auxiliary to continuity of service.

In order that there should be no excessive loss in distribution, these concentrated steam power units are usually found in the heart of the great distribution centers. Especially is this true where abundance of circulating or cooling water may be obtained. Thus we find in central California, Station A and Station C of the Pacific Gas & Electric Company, and the Fruitvale station of the Southern Pacific Company all situated in the distributing centers of San Francisco and its immediate vicinity. In Los Angeles we find that the Redondo plant of the Pacific Light & Power Corporation and the Long Beach plant of the Southern California Edison Company, owing to the lack of



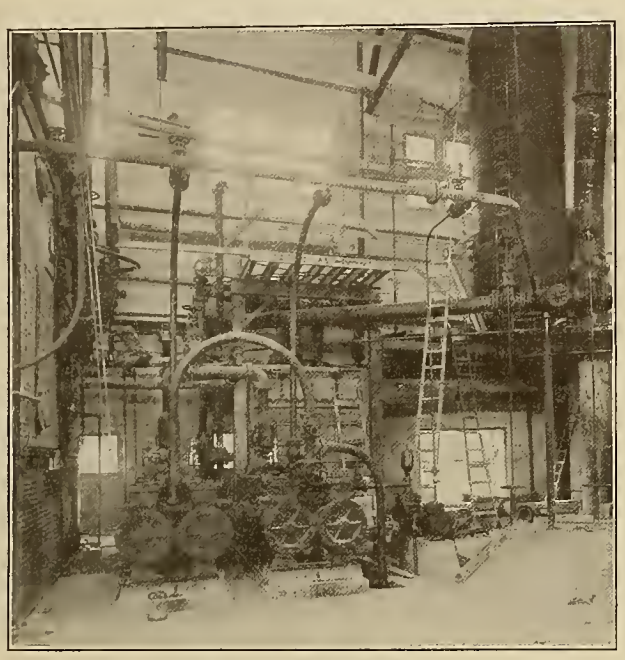
Interior of a Modern Horizontal Steam Turbine-Driven Electric Power Plant.

abundant cooling water near the distribution center, are situated at a distance from it of some fifteen or twenty miles.

General Description of the Modern Power Plant.

It will now be interesting and instructive to examine the details of a typical power installation of the sort just hinted at.

First, we shall describe the so-called steam cycle, or the journey of the steam making water from the time it enters the steam boiler until it has completed its journey through the turbine, or power unit, and returned again to the boiler; secondly, we shall consider the circulating water which is necessary in large quantities to convert the exhaust steam back again into water; and thirdly, we shall touch briefly upon the journey of the oil from the time it leaves the cars at the sidetrack until it disappears from the chimney



Boiler Feed Pumps.

as a flue gas. We shall touch briefly upon the general size and functions of apparatus employed to accomplish these results.

Steam Cycle.

Storage Tank. The supply of water for steaming purposes is usually brought to a make-up or storage tank from supply wells either on the immediate premises or nearby property. If these are not found, it is brought from rivers, lakes, or other bodies in the vicinity, or in many cases is purchased from some water company supplying the municipality. The storage tanks are varied in size, shape and capacity from a small tank, used as a receiver and hot-well, to a number of tanks, large and small, used for storage purposes only.

The use of storage tanks depends upon the source and quantity of water supplied and the load carried by the plant. Where there is a steady and positive source of supply, the tank may be of small capacity. In some cases where the supply is small and the storage at different periods is unfit for use, larger storage and settling tanks are required, and at times even filtration and cleaning tanks also are employed.

Pumps for Storage Supply. The tanks above alluded to, are filled either by pumps, gravitation flow, syphons, or piping from a water company's main. There seems to be no standard type of pump. Both reciprocating and rotary appear in standard practice. On the other hand, many plants have wells, and water is lifted by air pressure. This, on account of the total absence of working parts, is particularly useful where there are a number of scattered wells, and, also, when it becomes necessary to handle dirty water, that is, water containing sand, grit and dirt in suspension. This air lift consists of a partially submerged water pipe and an air supply pipe. The casing of the well is driven below the lift pipe. The lift pipe is set in the well either with air surrounding it between the pipe and the casing or with a cap over the casing, thus making the space in the casing air-tight. In some instances the well casing is used directly as the lift pipe.

The Hot-Well. The water from the storage tanks is either pumped or is caused to flow by gravity to a so-called hot-well. The hot-well is a tank which stores the water before it passes to the feed-water heater. It receives water from the condenser and admits an additional supply from the storage tanks to meet the needs of steam generation.

Feed-Water Pumps. From the hot-well, water is taken through feed-water pumps into the feed-water heater. The function of a feed-water heater is to heat the entering water to a temperature approximating that of evaporating conditions in order to keep the boiler at as even a temperature as possible and at the same time to put the exhaust steam from the auxiliary apparatus to some useful purpose.

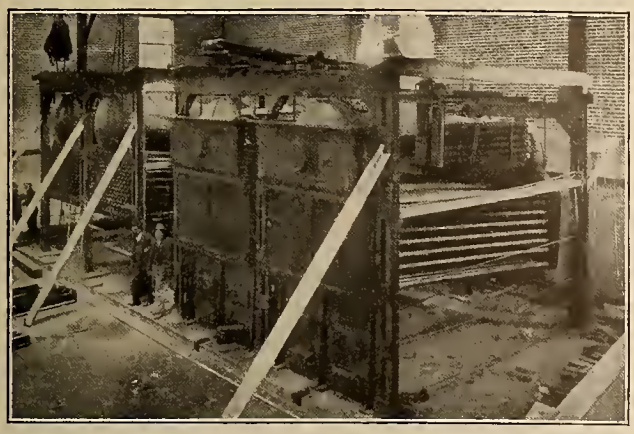
Feed-water heaters are divided into two general types: open and closed. In the open heater the steam comes in direct contact with the cooling water, and if there is a sufficient quantity of steam, it raises the water to 212 degrees F., the excess steam passing to the atmosphere. In a closed heater, on the other hand, the water is not exposed to the air and, if necessary, can be raised to boiler temperature. The water from a closed heater is as a rule much cleaner, since at high temperatures the deposits and minerals in solution are precipitated.

In steam plants where closed feed-water heaters are used, the boiler feed pumps are placed before the heater, thus pumping through the heater to the boiler. When open feed-water heaters are used, however, the boiler feed pumps are placed between the heater and the boiler.

Economizers. Economizers are sometimes installed in place of feed-water heaters. The economizer is a series of pipes through which the feed-water passes, placed in the path of escaping gases from the boiler furnace.

The Boiler. The boiler next receives the water from these heaters and converts it into steam at the desired pressure and temperature. The main types of boilers are water and fire tube. Modern practice indicates a decided preference for water tube boilers. A water tube boiler consists of steam and water drums placed on the top and a mud drum placed below, the two being connected by a series of tubes filled with

water or steam. The fire is below these tubes, and the heat from the furnace is made to pass around



Boilers in Course of Erection Showing Water Tubes.

them several times by means of headers or partitions, thus supplying heat for steam generation.

The Superheater. The water being thus converted into saturated steam by heat from the furnace of the boiler, is next passed through a series of tubes known as a superheater. These tubes are ex-



A Typical Arrangement of Boiler Installations.

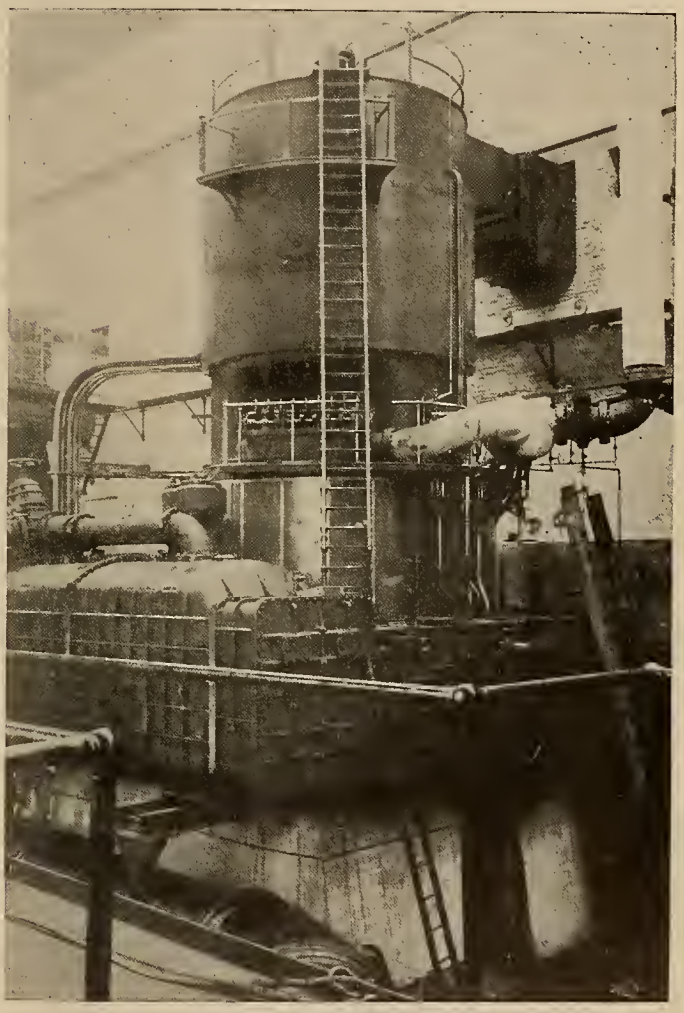
posed in a heated portion of the furnace and thus the steam is raised to a point much higher than its saturated temperature.

The Separator. From the superheater the steam passes through suitable piping to a separator, placed between the boiler and the engine, or between the boiler and the turbine. This separator is placed as near the power unit as possible in order to remove all condensed steam that may be found in the pipes. One form of separator performs its function by quickly reversing the direction of the flow of steam, thus depositing the water into a drip which is drained off into the condenser. Another form gives a rotary motion to the entering steam thus hurling particles of water off by centrifugal force and collecting in proper receptacles. Again baffle plates are at times employed wherein the flow is interrupted by corrugated or fluted plates, and the particles of water adhering to these, are then drained off.

Reciprocating Engine or Steam Turbines. The steam next goes from the separator to the main power generating units. The main units in earlier practice were reciprocating engines, in modern installations they are steam turbines.

Reciprocating engines may be divided into several classes, the details of which will not be outlined in this general discussion. Suffice it to say, however, that the main principle upon which reciprocating engines act is that steam enters a cylinder under pressure, thus forcing ahead a piston which is connected to a crank arm, thereby causing rotation and the consequent generation of power.

Steam turbines are divided into two general classes known as impulse turbines and pressure turbines. In the impulse turbine steam is allowed to expand in passing through a nozzle, thus causing the steam to travel at an enormous velocity. The steam, having



Vertical Type Steam Turbine With Condenser Base.

acquired this velocity by impinging against movable blades, causes rotation and the consequent generation of power. In the pressure turbine, however, the steam is allowed to enter the buckets or rotating vanes at a comparatively low pressure. These vanes are so designed that the steam may expand in this movable portion and by means of its expanding pressure cause rotation and hence the generation of power.

Turbines as a general rule have two other classifications known as vertical and horizontal. The vertical turbine revolves upon a vertical shaft, which is supported at the bottom by a thin film of oil under

the high pressure of about 900 to 1000 lb. per in. The horizontal turbine, however, as the name indicates, rotates on a horizontal axis, and is supported in the usual manner, by means of suitable bearings.

Condenser. From the steam turbine, the steam, having expanded to its useful limit, is dropped into an incasement through which cold water is being passed. Upon coming in contact with this cooling device the steam is again converted into water. The apparatus performing this function is known as a condenser, there being two general classes, surface condensers and jet condensers.

In the surface condenser the steam from the turbine and the cooling water from a nearby source of supply, do not come into direct contact, but the cooling water is passed through inclosed tubes around which the steam from the turbine or power unit is made to pass. This type of condenser is used where large quantities of water are available for cooling purposes but not for steaming purposes. Thus the use of salt water, the only abundant supply available for ocean-going steamships and large power plants situated near the ocean, makes a condenser of the surface type imperative for such installations.

In the jet condenser the supply of cooling water is allowed to mingle with the steam as it drops from the turbine or power unit and thus the steam is at once condensed into water. The water from the jet, being pure in supply, may be used in the hot-well for steam purposes.

Wet Vacuum Pumps. The condensed steam, now in the form of water, is pumped from the condenser back again into the hot-well by means of what is known as the wet vacuum pump. This pump may be either a reciprocating or rotary pump, but in general the rotary type seems to have the preference. Thus the entire cycle for the water is traced from the make-up tank or hot-well through the boiler and power unit, and back again to the hot-well.

Dry Vacuum Pumps. The condenser also has a dry vacuum pump in order to remove from the steam space within, any air which may have been trapped from the steam generated in the boiler. This pump is nothing more or less than an ordinary air compressor so designed that it will take air at a very low pressure and compress it up to ordinary atmospheric pressure, thus pumping, as it were, into the outer atmosphere such air as may have been entrapped in the condenser.

Circulating Water Cycle.

The description of the working of the condenser has shown that cooling water is necessary to convert the steam in the condenser back again into water. This cooling supply is known as circulating water, which is usually taken from some large natural lake or river or even the ocean through pipes, and forced by means of reciprocating or rotary pumps through the condenser and then back again into the open. The water in its journey is raised in temperature in the surface condenser system from 25 to 30 degrees F. above its entering condition.

The Oil Cycle.

Of general interest to boiler testing and operation is the oil cycle employed in the utilization of crude petroleum as a fuel. Let us then briefly trace the journey the oil makes through the modern power plant.

In the larger installations the oil is sidetracked from the main railway line in specially designed cars for its easy conveyance and handling. An oil heater, consisting of a coil through which steam is passing, is lowered into the car in order to warm the oil as it is drawn, thus making its transfer considerably easier. By means of a pump this oil is then taken into a storage tank which may be of wood, steel, or concrete, depending upon the permanence of design thought necessary. From this storage tank the oil is pumped through oil heaters, the exhaust from the pumps in many cases being utilized in still further heating the oil before it reaches the burner or atomizer.

An atomizer is a device used to vaporize or spray the oil into the furnace in fine globules or particles. This is either accomplished by means of steam, air, or some mechanical contrivance. Immediately upon its being sprayed into the furnace carefully designed air regulating devices admit sufficient air from below to cause perfect combustion. The heat thus liberated from the oil, due to its burning with the oxygen, is caused to flow in and around numerous tubes through which water is passing, and thus this water is converted into steam. After passing these tubes the heated flue gases brought to life by the burning of the oil with the entering air are then conducted through the chimney out into the atmosphere.

General Summary.

Thus it is seen in this brief description that by using crude oil as fuel three main cycles of operation are synchronously carried on in the modern power plant. Briefly summarizing, these are as follows:

Water is taken through the boiler, converted into steam and passed through a driving mechanism, after which the steam is re-converted into water and this water again passed through the boiler. Simultaneously with this action water is being pumped through the circulating system to bring about the conversion of the steam from the power unit into water. Again oil in a finely atomized or gaseous state is being fed through pipes into the furnace, where it immediately combines with the proper quantity of oxygen from the entering air, and thus sufficient heat is liberated from the oil to evaporate the water supply of the boiler into steam or power generation.

[To be continued.]

The electrical distillation of turpentine is an established industry at False Creek, Vancouver, B. C. This is one of the lesser known uses to which electrical energy can be put, but is one advantageous to central station and consumer. The Douglas fir there used contains a large quantity of turpentine and with waste from the mills in abundance, and comparatively low rates for energy, profitable results have been obtained. In addition to the turpentine extracted, the by-products such as charcoal, resin, wood tar, and tar oil, also add to the profits. The average yield from each ton of wood treated is approximately 13.5 gal. turpentine; 650 lb. charcoal; 335 lb. resin; 135 lb. wood tar; and 10 gal. tar oil.

OREGON ELECTRIC RAILWAY STATISTICS.

Preliminary figures of the forthcoming quinquennial report on the electric railways of the state of Oregon have been given out by Director W. J. Harris of the Bureau of the Census, Department of Commerce. They were prepared under the supervision of W. M. Steuart, chief statistician for manufactures.

The statistics relate to the years ending December 31 for 1912 and 1907, and June 30 for 1902. The totals include electric light plants operated in connection with electric railways and not separable therefrom, but do not include reports of mixed steam and electric railroads nor railways under construction during the census year which had not begun operations.

The figures as presented for the state of Oregon show substantial gains for the decade 1902-1912. The number of operating companies—six—remained the same. There were 545 miles of track in 1912 as compared with 137 miles in 1902, or an increase of 299 per cent. The persons employed numbered 3,041 in 1912 as compared with 525 in 1902, or an increase of 479 per cent. The revenue passengers carried numbered 75,842,324 in 1912 as compared with 18,729,442 in 1902, or an increase of 305 per cent. The gross income in 1912 amounted to $7,856,471 as compared with $1,042,895 in 1902, or an increase of 653 per cent. The operating expenses in 1912 amounted to $3,736,259 as compared with $653,912 in 1902, or an increase of 471 per cent. The total horsepower developed was 109,450 in 1912 as compared with 4250 in 1902, or an increase of 2475 per cent.

The figures are shown in detail in the accompanying table:

Oregon.	1912.	1907.	1902.	Per cent of increase: 1902-1912.
Number of companies (all operating)	6	8	6	.....
Miles of line	389.11	169.28	94.40	312.2
Miles of single track	544.64	253.41	136.67	298.5
Miles of single track in state[1]	567.48	259.02	136.67	315.2
Cars, number	1,400	670	279	401.8
Passenger	722	466	250	188.8
All other	678	204	29	2,237.9
Electric locomotives	22	7	....	.....
Persons employed	3,041	1,216	525	479.2
Salaried employes	698	93	35	1,894.3
Wage earners (average number	[2] 2,343	1,123	490	378.2
Power:				
Horsepower	109,450	.....	4,250	2,475.2
Kw. capacity of dynamos	38,740	80	3,294	1,076.1
Output of stations, kw.-hr.[3]	169,609,004	73,000	7,144,692	2,273.9
Current purchased, kw.-hr.	12,937,739	(4)	(4)	.....
Passengers carried	101,194,838	63,930,947	23,666,753	327.6
Revenue	75,842,324	49,459,483	18,729,442	304.9
Transfer	21,916,726	12,146,734	4,937,311	343.9
Free	3,435,788	2,324,730	(4)	.....
Car mileage (passenger, express, freight, etc.)	19,509,670	15,025,037	4,781,105	308.1
Condensed income account:				
Gross income	$7,856,471	$3,627,990	$1,042,895	653.3
Operating expenses	$3,736,259	$1,638,271	$653,912	471.4
Gross income less operating expenses	$4,120,212	$1,989,719	$388,983	959.2
Deductions from income (taxes and fixed charges)	$3,050,248	$992,748	$146,519	1,981.8
Net income	$1,069,964	$996,971	$242,464	341.3

[1] Including track in state owned by outside companies.

[2] Number employed Sept. 16, 1912.

[3] The decrease in power and output of stations in 1907 as compared with 1902 and the increase in 1912 as compared with 1907 are due to changes in the organization of electric station and electric railway interests. In 1912 the central electric stations and electric railways combined reported a total output of 228,398,346 kw.-hr. as compared with 92,880,992 kw.-hr. in 1907 and 24,676,352 kw.-hr. in 1902.

[4] Figures not available.

STANDARD SPECIFICATIONS FOR POLES.

Western Red Cedar.

The following are the revised official specifications of the Western Red Cedar Association covering standard telephone, telegraph and electrical distribution system poles in sizes of 4 in. 20 ft., and upwards:

All poles must be cut from live, growing cedar timber, peeled, knots trimmed close, butts and tops sawed square, tops must be sound and must measure as follows in circumference:

Poles.

Top.	Circum.
4 in.	12 in.
5 in.	15 in.
6 in.	18½ in.
7 in.	22 in.
8 in.	25 in.
9 in.	28 in.
10 in.	31 in.

Crook.

No pole shall have more than one crook, and this shall be one way only, the sweep not to exceed one inch to every six feet in length. Same to be determined in the following manner: Measurement for sweep shall be taken as follows: That part of the pole when in the ground (six feet) not being taken into account in arriving at sweep, tightly stretch a tape line on the side of the pole where the sweep is greatest, from a point six feet from butt to the upper surface at top, and having so done, measure widest point from tape to surface of pole, and if, for illustration, upon a 30 ft. pole said widest point does not exceed five inches, said pole comes within the meaning of these specifications.

Butt Rot.

Butt rot in center, including small ring rot, shall not exceed 10 per cent of the area of the butt. Butt rot of a character which impairs the strength of the pole above the ground is a defect.

Knots.

Large knots, if sound and trimmed smooth, are not a defect.

Dead or Dry Streaks.

A perfectly sound, dead or dry streak shall not be considered a defect when it does not materially impair the strength of the pole.

A basic system of rate making at once simple and comprehensive, would be welcome alike by central station managers, salesmen and others. It should be easily understandable by the customer and might be expressed in a simple formula such as for example,

$$D = \frac{L}{C^2} \text{ bmnaev} \sqrt[3]{\text{ablg}}$$

where D is the rate in dollars, L the actual load, C the load connected, and so forth. This would cover all conditions, give a ready means for a rough (?) check to be made each month by the customer, and would thus prevent fraud and relieve the public service commission of a present excessive burden. This is proposed, with apologies, as an amendment to suggestions made by an English correspondent.

PUBLIC POLICY OF PUBLIC UTILITY CORPORATIONS

BY S. WALDO COLEMAN.

"Do unto others as you would they should do unto you, but do it first."—David Harum

(The author, with interspersed business philosophy, states clearly the situation and relationship between the public utility and the public it would serve, and proposes in the interests of all a policy of educational publicity. Mr. Coleman is president and general manager of the Coast Counties Gas & Electric Company, Santa Cruz, Cal.—The Editors.)

Have you noticed how a cheerful man carries an atmosphere of joy and cheerfulness wherever he goes? How his own cheerfulness becomes so infectious that, in turn, it makes others about him cheerful. It is equally true with frankness, fairness and mutual understanding. It should be axiomatic that to receive frankness, it is only necessary to be frank; to be treated fairly, it is only necessary to be fair; and to be sympathetically understood, it is only necessary to first sympathize with others. We do not presume to make such an absurd statement as to claim that these suggested axioms are true at present, but we do claim and insist that these axioms are ultimately possible, provided that we truthfully apply the Golden Rule of David Harum—"Do unto others as you would they should do unto you, but do it first."



Public Utility a Tenant.

Herbert Spencer, in his "First Principles," states that before delving into the Unknowable, it is best to start well within the Knowable. Likewise, before deciding on a policy for a public utility company to pursue in its dealings with the public, it is well to first decide on our interpretation of what a public utility is. A public utility is a person, firm or corporation engaged in the business of supplying a utility to the public in a manner requiring the use of certain property of the public. The manner of the use of this property (belonging to the public) is stated more or less definitely in the grant, either in the form of a constitutional right, or a franchise right, but is always subject to the general power of regulation. In fact, outside of the power of confiscation, the state has reserved to herself complete power over all utilities, and a person operating or investing in a utility should realize this. As a utility uses the property, subject to practically any order of the public, it is acting but as the tenant of the public and as such a tenant it is evident that our first duty is an accounting of our stewardship. Practically no head of a utility corporation can truthfully say that his company has given the public all the information which he (as an owner) would want to have from a tenant; and a public utility is nothing more than a tenant serving its master (the public) under a contract (franchise).

Case of the New York, New Haven & Hartford.

Take the case of the New York, New Haven & Hartford, a railroad with tens of thousands of stockholders, and a very part of the life of New England. How much did the stockholders, not to mention the public, know about the wild extravagances and increased fixed charges added in a vain attempt to completely monopolize the transportation business of New England? Nothing, until the terrific accidents and loss of life resulting from such wild management awoke the people to a realization of the truth. How can you expect the public to be frank with the public utilities when, in the past, not even the stockholders have been generally dealt with frankly. One of the greatest fields for the improvement in the relationship of the public and the public utility, lays in more frankness, openness, on the part of the utility. If a utility has done right, it should not fear publicity. If it has been guilty of dishonesty, etc., the permanent development of the public utility business is advanced by its just condemnation. The way to educate the public to be frank with us, is to first be frank with them.

Abuses by the Public.

Due largely to the fact that utility corporations representing an aggregation of capital, have generally been so secretive in their business, failing to give an accounting of their stewardship, there has become a world-wide tendency to hamper such corporations, and unfortunately the public has not differentiated between the corporations honestly and fairly conducting business, and those that are not. It has resulted in making it difficult for public utilities to obtain the money needed to make necessary improvements and extensions which would not only be of benefit to the companies and their customers, but also to the cities served by the companies. As is well known, baiting of public utility corporations has been common practice among some politicians.

Public utility corporations can overcome this by candid publicity, but the public are human and will not take the time or trouble to find out what our just equities are unless they are shown them. Some will say that the public are suspicious, always looking for the "nigger in the wood pile," so to speak. Well, why shouldn't they? We do not accuse corporations of downright falsehoods so much as of the crime of telling only half the truth. Take the ordinary earning reports of public utility corporations; how many of them show depreciation?

In the past it has been considered necessary to make exceptional earning statements in order to get the money desired for extensions, but this is a different age, an enlightened age, and in order to get the public to invest they must know all the truth. One reason the public is not investing in utilities is that they are told nothing about the details of the public utility business and fear other cases like the New York, New Haven & Hartford. In order to get the public to invest in our business, it is therefore necessary that we educate them to the stability of our business. And statistics show that no class of business is so stable, so reliable, so little effected by panics, as that of the public utility business.

Status of Watered Stock.

There are various kinds of "watered stock" and where no consideration in any form has been received, it is certainly not just to exact from the public, money to pay interest on such stock. There is one class of "watered stock" though, the value of which is not understood by the public. We refer to stock given as a bonus with bonds. For many years, in fact until the introduction of regulation by commissions, it was often the practice to raise the money for construction purposes by the issuance of bonds with a certain amount of stock given free with each bond. Many honest investors put their money into utilities, paying par for five per cent bonds with one hundred per cent stock bonus, at a time when money was worth seven per cent, eight per cent, or even more. Much of this was invested during the infancy of the electric art and the investment was highly hazardous. In other words, at a time when conservative, cautious investors were getting six and seven per cent with safety, these other men were risking their money in a hazardous undertaking. If their investment had been a loss, the public would not have recompensated them. Likewise, since their undertaking has been a success, they should be allowed to earn considerable more than ordinary interest. In the case cited of paying par for a five per cent bond with one hundred per cent stock bonus, since the bond pays a fixed interest of five per cent, sufficient interest should be allowed on the bonus stock "watered stock" so as to allow at least eight per cent on the total investment. If this is done the public is not being called upon to pay more than if the utility was paying eight per cent on stock sold at par. In regard to the amortization of his investment by the time of the end of the franchise, that, of course, should be figured, in this case, on his bond investment and interest only figured on his bonus "watered" stock. We do not mean to advocate the issuance of such bonus stock now, rather we are unequivocally opposed to it, but the early investors should be properly compensated for the risks they took during the early life of the industry.

Public Must Not Kill Incentive.

In order that public utilities may expand, serve new sections of growing communities and increase the service to present districts, it is necessary that sufficient capital be obtained, and no business requires as large amount of capital in proportion to gross business as the public utility business does. In order that communities may be served at as low a rate for electricity and gas as possible, it is necessary that the managements be given some incentive. As people invest in public utilities for profit, that incentive should be in the form of increased allowable net earnings in proportion to increased efficiency in the operation of their property. If this is not done, the natural result will be an unwillingness on the part of owners of public utilities to spend money in reducing expenses or increasing earnings if they are to be held to a fixed return on the money actually invested. Regulation that removes all incentive for developing and expanding on the part of the utility company, results in a community being poorly served and its growth retarded.

Regulating Commissions.

"But why bother and go to the expense of educating the public to all this? We have regulating bodies, commissions, who have, or will have, control in all such matters. It is only necessary when matters come to an issue to let them know all these things you have spoken of." Wrong again. A commission, such as a railroad commission, is a representative body and the public has simply delegated this control to them. Their term of office is short and their reappointment, or the character of the new appointees, ultimately depends absolutely on whether the public has been satisfied with their stewardship of this delegated power. Strong commissions may be leaders in forming public opinion, but in the last analysis they are but the representatives of the people and as such, when the people clearly state their wishes, it is their duty to abide by them.

Government Ownership.

Regulation is but a stepping stone to government ownership, and by government ownership we mean ownership either by the Federal government, state government or a subdivision thereof such as a municipality. My! But why fear? As a tenant we have simply received notice to get our house in order. We took the house subject to such a power on the part of the landlord, and the issue is not whether we should give up the house, but, rather, how to obtain just compensation for the expenditures, improvements we have made in it. Here again we must realize that the public will be the final judge of what that compensation will be. The fairness of the public in reimbursing us for moneys spent and improvements made will largely, if not entirely, depend on our thoroughly keeping the public informed of the heavy expenditures as they are made throughout our tenancy.

The Germ of the Policy.

The germ of our public policy should therefore be EDUCATION. EDUCATE the public to be frank and open with us, by being frank and open with them, EDUCATE the public to be fair with us, by first being fair with them. EDUCATE the public to sympathetically understand our difficulties, by first explaining what they are to them. Remember that the great accomplishments, especially in Germany, have been brought about by Education. Remember that public opinion is merely human opinion, and it is therefore not infallible, and subject to education.

Public utilities have performed wonderful engineering feats, but have been generally signally unsuccessful in wielding public opinion. But let us not be disheartened. Remember the saying of Confucius, "He is not strong who has never fallen, but rather he who having fallen has gotten up again."

Utilities are misjudged today but the same ability and perseverance that has built the wonderful dams, power houses and transmission lines should be able to correct this, and in the future the strength of a management will be largely measured by their ability to correct this misunderstanding.

Today, in general, utilities are giving good service, but these misunderstandings can only be eliminated by a system of EDUCATION.

DISCUSSION ON JONES' WATER POWER BILL.

The Bill Reviewed and Supported.

San Francisco, February 24, 1914.

Present regulations regarding the use of the public domain in water power development are most severely criticized for the revocable nature of the licenses granted, and for the annual tax imposed.

Although in both the regulations of the Department of the Interior and the Department of Agriculture it is conceded that the state and not the nation has control of water rights, still the annual tax is levied on the capacity of the plant.

The bill proposed by Senator Jones aims to cure this defect by fixing the annual rental at "a sum equal to five per centum upon the fair market value of such land as so determined by agreement or final adjudication." The bill, therefore, places the nation just where it should be—that is, in the same relation to the power project as is an individual or corporation owning lands which must be occupied. As in case of failure of agreement by the Secretary and grantee regarding the market value of the land the value must be fixed by the court, it is certain that the rentals to be paid will be very materially lower than those now exacted by regulation.

The bill gives the right to the grantee to occupy the land for a period of 50 years "and after the expiration of said period of 50 years such right shall continue until compensation has been made to the grantee for the fair value of its property as herein provided."

As provided in Section 4 of the bill, in case of taking at the end of 50 years, not only must the just market value of the entire plant be paid, but the public unit taking the plant must assume all contracts entered into by the grantee which have the approval of the proper public authorities. In case of failure of the parties to agree upon the purchase price for the plant the price is to be fixed by regular proceedings in a Federal court. The proposed tenure, therefore, is practically an indeterminate license.

From the standpoint of the public the bill provides all necessary protection. As stated in Section 3 "no value shall be claimed by or allowed to the grantee for the use of or the right to use the lands acquired under the term of this act" in case of taking over the property. Section 6 provides that rates and services shall be subject to lawful regulations by the respective states having jurisdiction, and by the United States in case of interstate business, or in extreme cases where the states or local authorities fail to exercise the right of regulation.

As the bill seems to meet the demands of all but the extremists among the so-called "conservationists" on the one hand, and those actually engaged in power development on the other hand, it is to be hoped that all interests will join forces in assisting in the passage of Senator Jones' measure.

Very truly yours,

(Signed) A. E. CHANDLER.

Suggested Amendments.

San Francisco, Cal., Feb. 24, 1914.

Development of water powers, essential to the needs of an advancing civilization, are necessarily made in advance of present needs, that actual needs may be supplied upon demand. The hazards incident to such investments, the long period of construction devoid of income, and the lean years usually following completion, entitle the developer to fair consideration by the public. Municipalities often consider a bonus paid to an industrial enterprise a good investment.

The benefits resulting from successful development of water powers which create new pay rolls, are distributed to the public, in which the builder is a unit. Results of adverse legislation or other artificial obstruction which shrinks or kills the payroll, are also shared by the general public. The aim of the government, therefore, should be to assist the builder if assistance be needed. Prospective pay for good work, and the satisfaction resulting from the accomplishment of a difficult task which creates and sets in motion new industrial wheels, are the builder's incentives to great undertakings.

The most important factor in any legitimate investment is its stability. There must be a substantial physicial, moral and legal foundation under any successful enterprises. Under existing laws, rules and regulations of the Federal government, this stability factor is practically eliminated under the legal status, owing to the uncertainty of tenure under revocable permits, and regulations which may be changed at any time in the discretion of the Secretary or his successor. This illogical situation, inconsistent with the proper conduct of business, must be changed to a rational basis if the West is to be further developed.

Believing "that government best which governs least," that "in all that the people can individually do as well for themselves government ought not to interfere," and that the nearer home public authority is exercised the better for all concerned, I think the development of water powers should be exclusively under state control, and the offices of the Secretary limited to granting rights of way as custodian of the public lands and not empowered to exercise any supervisory powers over developments by citizens or corporations. However, there are many who hold different views, and this bill seems in general a reasonable compromise. It eliminates much of the uncertainty under present laws, will materially aid in financing projects, and should satisfy the proponents of Federal control.

Section 2 of the bill makes the approval of the Secretary contingent upon his judgment of whether the proposed plans will promote the highest use of the water. This I think could be improved by making the approval of a grant contingent upon a showing that the grounds applied for would not be damaged beyond the power of the grantee to repair. The use of water is already under State jurisdiction. Provision should also be made allowing the grantee to perform sufficient work on the ground during negotiations with the Secretary to preserve the water right under the state laws.

Under Section 5, the grantee is required to complete and put in operation such part of the ultimate development within seven years as the Secretary may direct and complete the ultimate development under direction of the Secretary. As the state public utility commissions have jurisdiction with respect to extensions, improvements and betterments, and effectually protect consumers in the character of, and rates for service, conflicts in dual authority would likely arise resulting in confusion, delays and loss. These contingencies may be easily avoided by a slight change in the bill. The rights and duties of citizens in so far as is possible, should be explicitly defined by law, and not left to individual opinion. I beg to suggest for consideration the following in lieu of

Sec. 5. That in order to prevent tying up for speculative purposes, any of the lands to be acquired under this act, the grantee shall commence the construction of the project within two years from the date of the agreement, or in the event of failure to agree, then the date of final adjudication as to the value of the land to be occupied, and shall thereafter in good faith, continuously, and with due diligence prosecute such construction; and, for the purposes of this act, "due diligence" shall mean completion of the works, or operating units thereof in time to meet public necessities which will afford a reasonable market, and shall so continue such construction to the ultimate development of the project as may be economically justifiable to adequately supply reasonable market demands, and as may be ordered by the states public utility commissions.

This suggested change would remove one more possible uncertainty, and prevent conflict of authority.

Though the other important features of the bill providing for payment for use of land, sale of the plant, and indeterminate grant after 50 years are not entirely satisfactory from a developer's point of view, the bill as a whole, if made into law will greatly improve present conditions. It is a long step in the right direction. Any change that will substitute stability for uncertainty, confidence for suspicion, sound understanding in place of confused theories in a cloud of smoke, and start the water wheels humming, is the desideratum, and of much greater importance than the question of Federal or state control. The bill offers a good meeting ground for these contending factions.

Very truly yours,

(Signed) W. A. COOPER.

Would Oppose Proposed Water Power Legislation.

San Francisco, February 25, 1914.

I am opposed to the proposed measure because it does not provide for the development of water power by any agency save that of the "state, municipal subdivisions or public utility corporations." It leaves a construction as to the meaning of the act open to litigation upon the question whether a private development of waterpower would have to be made under the act of February 15, 1901, or whether it could be made at all. This would affect the rights of miners, irrigationists and others.

It upsets modern legislation passed by the states by taking from the authorities accustomed to pass upon the needs of a community, the settling of questions of fact and of expediency and places such power in the hands of the Federal courts.

It is not sufficiently definite as to the basis upon which the 'fair market value" of the land is to be decided. If it is to be decided with a view to the present value of the land as real estate, simply, the measure will meet with great opposition from the administration and the conservation element of the public. If it is to be based upon the value of the land for its power site, opposition will probably be made by the public utility seeking to acquire the right to use the land

The provision to allow Congress to declare a right forfeited at the end of fifty years is bad. It will promote lobbying at Washington and may result in the right granted being turned into a perpetual franchise. The term granted by the proposed act, is in substance, a limited or indeterminate franchise; but if there were no agency ready and willing to take over the properties of the present public utility possessing the same, at the end of the fifty years, conditions might be such that this franchise might become perpetual. It might be so that the contracts entered into by the corporation might have been very unfair at the time the agency designated by Congress to take over the rights of such corporation shall accept them and if no agency can be found to take over the property and contracts of the original user he would hold them forever. It would tend to encourage a corporation to manage its affairs in such a way that none other save itself could afford to operate the plant.

The provision for placing the valuation of the properties so to be turned over to the agency designated by Congress is bad because it also ultimately forces the applicant and the federal departments into litigation. The laws of the state of Wisconsin and of other states having modern laws regulating public utilities provide that such valuation shall be made by the railroad commission.

The most objectionable of the features of the proposed measure is contained in section five. This section provides a method for the prevention of speculation in water rights and in the lands to be acquired under the act. It, however, fails absolutely to accomplish such purpose. The laws of the state of California relative to water power use, provide that when a permit is granted by the state to use water for power purposes, actual construction work shall begin within six months from the date of the permit. The proposed measure says that such work shall be commenced within two years from the date of the final adjudication of the value of the land to be used for the power development. Therefore an applicant for the use of water for power purposes might get a permit from the state commission requiring him to commence work on the project in six months. He would then get the right from the Federal government, after probable litigation covering several years in the courts, to commence the construction of the project within two years, from the date of the determination as to the value of the land. In the meantime the state commission may revoke his permit because actual construction work has not commenced in the time allowed by law. Or, on the other hand, the Federal courts, or the state courts, in case of appeal to them from the action of the state commission, may decide that he was prevented from so commencing such construction work by reason of the litigation. This might be done on the ground that he was using due diligence to comply with the state law and was prevented from so doing by reason of such litigation If a "promoter" was so disposed, he could tie up that particular piece of land and the water dependent upon the use of such land, for an indefinite period of time, or until he could dispose of his rights therein to some bona fide developer. In case he so disposed of his rights the real development would be at the added expense caused by the necessity for paying off this "promoter" in order to get him out of the way. The rate at which the real promoter might dispose of the commodity produced by the "plant" would have to be increased because of this added cost of acquiring such rights.

The provision requiring an appeal to the president in case of the necessity for an extension of time in which to complete any one unit of the construction puts an additional burden on the prospective utilization of lands in this state. It is an unnecessary provision as the authority having in charge the use of such land would be the real agency deciding such matters as they would be referred by the president to the officer having jurisdiction over the lands in question.

The proposed measure as a whole is not comprehensive enough in its provisions. It leaves too many questions to the courts for settlement and instead of simplifying the procedure of gaining rights to develop water power sites, tends to multiply the already great difficulties in the way of the bona fide development thereof. It leaves the terms of the proposed act open to misunderstanding is ambiguous in its meaning and tends to promote litigation. Litigation is tedious and expensive. Nothing will so discourage the development of the water resources of this country as the necessity of going into court every time any difference comes up. It is a matter of record and of public knowledge that certain litigation over water rates started in the courts of San Francisco county in 1901, 1902 and 1903 have not yet been decided. All litigation is long drawn out and tedious owing to the overcrowded condition of the courts, both state and Federal; but water litigation is doubly so on account of the many angles such litigation may develop. These matters of water rights are best settled by a commission than by a court. Commissions are not bound by the technicalities with which the procedure in courts is surrounded. They are not bound by precedents established years ago and which do not fit present conditions. They can give more ready and equitable relief than can any court in the country.

I am also opposed to the passage of any measure that has not been drawn with a thorough knowledge of the subject of such legislation. Too many relief measures touching the use of water have been passed without affording any relief.

A careful study should be made of the needs of the various states of the Union before final legislation is proposed. Such legislation should be so comprehensive that all former legislation on the subject could be repealed by the later act. This would avoid conflict in the laws and the necessity for litigating every question that might arise. An effort should be made by any new legislation to reduce the number of agencies to which the intending applicant for water power would have to apply. At present there are at least three different bureaus to apply to and a possible fourth. I refer to the state water commission, the state railroad commission, the Federal forest service and the Federal interior department. Any one of these bureaus may fail to see the necessity for granting a right asked for. The applicant has been put to the expense of securing data and surveys and the services, in many instances, of an attorney. If he loses out he has had all of the outlay for nothing.

A plan, which is not without merit, was suggested to me some time ago for the solution of this problem of procedure. It was to have the state through the railroad commission handle the whole matter of applications for water rights and rights of way upon the public lands. When an applicant applied for such a right, the state would investigate the matter, and. if found feasible and in good faith, the state would apply to the Federal authorities for a lease of the power site at a nominal rental. The state would then give a permit for the use of the water and a lease for the use of the land. All revenue acquired from such use would be paid into the state or county treasury. In that way the state would ultimately gain the use of the lands within its boundaries. The treasury of the state or county, as the case might be would be enriched by the receipt of moneys that have heretofore gone to the Federal treasury. The old cry of the counties against losing the money that might otherwise come to it if it had the use of the lands withdrawn by the Federal government would be, in a measure stilled and the way of the intending developer of water power made smoother and such development encouraged.

In conclusion I will say that I cannot see that any particular benefit will accrue to the Western states through the passage of the Jones measure, nor do I believe such a measure will work out satisfactorily. On the contrary, for reasons herein stated, I believe it would tend to throw the whole subject of water development into worse confusion than it is at present.

The within expressed views are merely the expression of my own personal ideas gathered from ten years' familiarity with matters relating to the natural resources of the United States.

Very truly yours,

(Signed) HORACE TILLARD JONES.

Thinks Favorably of the New Water Power Bill.

San Francisco, Feb. 26, 1914.

Having had long and close contact with the subject of the development of hydroelectric power on the public lands and much dealing with the Federal government in acquiring rights of way, the Jones bill reads as if it were written as a result of these experiences.

The method of adjudicating the basis of value upon which to fix the charge of rental is fair and just, and has the advantage of being clear of any chance of a dispute.

The amount of the charge should be as little as possible as it is chargeable to the consumer, but also should be enough to compensate the government for the cost of administration of the lease.

The lands occupied would be leased for a term of years with the right of continuance or purchase at the date value by the government which is fair to both.

It meets the conditions of exempting from double regulation in states where regulation is now, or will be done by public service commissions and this will mean all of them before long.

It provides a workable way out of that most difficult problem, that of installing to meet demand without doing so at a needless interest expense on plant not immediately needed.

This difficulty is great and varies with the growth of communities.

It recognizes the tendency toward the ownership of works by the general public through state and municipal ownership which places all on a parity with privately owned public service. Section 9 is the clearest definition of the difference between "good" and "bad" trusts that I have yet seen, and this clause, modified to suit, would cover the subject of trust control and do away with the useless and harmful badgering of big business that until quite recently has been so popular with the trust busters.

If the finances and financial methods of a trust are under control, and the price at which a commodity is to be delivered to the consumer is regulated the size of the production plant need be limited only by the size it must be to be most efficient.

The public can be best, and most cheaply served by a single public service concern in each line in each community. All rival plants in the same territory should be consolidated for efficiency of operation. The need of competitive regulation has been removed when the service is commission regulated.

When public service is commission regulated it is impossible for it to be operated in restraint of trade.

Competition should be discouraged because it is wasteful and inefficient as a regulating device.

Public service should be commission regulated because it tends towards efficiency and economy.

Very truly yours,

(Signed) JOHN S. EASTWOOD.

Opposing View of the Jones Bill.

San Francisco, Feb. 27, 1914.

The trouble with the Jones bill (Senate 4415) is that it ought not to be. The good that its enactment might do is little and fleeting; the ill that its enactment could do is great and lasting.

The provision (Sec. 2) for the making of the fair market value of the public land occupied by the hydroelectric power works the basis of a 5 per cent rent charge to be paid the United States for the use, is good, in that it is a recognition by Congress of a commercial rule of business which had already been made law by the supreme court decision in the Minnesota Railroad Rate case. It is a promise of common honesty from the government in its future dealing with the people, where its present dealing, persisting despite the supreme court ruling, is dishonest. The Interior Department still collects rent from hydroelectric power users of public land estimated on the electric power output produced from the Heaven given water flowing over it; practicing in its hydroelectric power business regulation the maxim of the elder Huntington, "Charge all the traffic will bear," which the Commerce Department abhors and repudiates in railroad business regulation.

The provision (Sec. 3) that rent payments for the use of the public land shall not be capitalized and made the basis of an income earning, is good. True; no hydroelectric power user of the public land had ever done it, nor any efficiency engineer proposed doing it, but there's no telling but that some future captain of chain-bound industry might think of doing it, unless a United States senator thought of it first and nailed it down.

The provision (Sec. 8) that all water power reserves may be opened by the president to settlement and disposal, is good, if may in this bill has the force of must. There never was, nor is, the wisdom that a titmouse's brain might conserve, embodied in the making of so-called water power re-

serves of the public land. The reservation in patents hereafter issued, of rights of way for water uses which, though now and at the date of patent issue are and may be undefined, is good—if it be law which Congress may make. The principle under it was law in Mexican territory when Texas seceded and when the Treaty of Guadaloupe Hidalgo was ratified, and it may still be law in Mexico. It was law in the state of California, being adapted from the earlier Mexican law in the land, prior to the enactment of the civil code in 1872. (See Act. App. May 15, 1854; and Act App. April 28, 1860.) The point of the reference being, that this provision of the Jones bill is a matter within the states' legislative jurisdiction, and not within the jurisdiction of Congress, therefore the enactment of Congress cannot make it law.

The provision (Sec. 1) limiting the grants of rights of way to municipal and public service corporations, is bad. Why must similar grants of rights of way on the public land be denied to private persons for private uses of hydroelectric power or water? Why has not a farmer, a miner, a manufacturer, just as good a right to own a hydroelectric power plant for his private use, as he has to buy hydroelectric power from a public service corporation? Why this preference in the law for corporations and implied prejudice against persons? Are popular rights only for corporations?

The provision (Sec. 2) granting rights of way on Indian reservations, is bad, because it is bad faith, to say the very least of it. The Indian reservations are owned by the Indians, who in California, Nevada, Utah, Arizona and in part of Wyoming, Colorado and New Mexico, are full citizens; and who, in other states, are wards of the United States. By what right, other than the might of superior brute force, does the Federal government assume to grant land of citizen Indians, and presume to grant land of Indian wards? If Indian citizens' land can be taken by authority of act of Congress and granted or let, why may not your land and my land be taken by virtue, or at any rate under, the same authority. If the fifth amendment to the constitution is to be futile to protect Indian citizens and Indian wards from despoilation by the Federal government, may it not also be futile to protect you and I from being despoiled of our land by a despot in power at Washington?

The provision (Sec. 2) excluding national parks and monuments (which are merely lesser parks) from the public lands over which rights of way may be granted, is bad. Except Yellowstone Park and some other lesser parks excluded from cessions of jurisdiction on the admission of new states, the National parks are state territory, just as is other public land. Why the rule of tweedle-dee for some public land, and why the rule of tweedle-dum for some other public land? Does Jones know why? His reason "why" ought to be in his bill. It is nowhere else.

The provision (Sec. 2) requiring a filing of maps, plans and specifications of the hydroelectric power or other waterworks, needing rights of way on the public land, with the Secretary of the Interior, is bad. It loads a useless and economically needless preliminary expenditure on these enterprises of anywhere from $5000 to $25,000. Before such laws were made no one thought of expending investment money for maps and plans of the character demanded by this bill. People built the waterworks first, and maybe they mapped them afterwards and maybe they didn't. It did not matter because they ran just the same either way. Now it has been made to matter—and to cost—likewise to waste time in getting official approvals, which, consting money, contribute to raise the cost of hydroelectric power and water to the users. The bill, in this matter, would make an acute complaint of this business, become its chronic state.

The provision (Sec. 6) that the United States reserves the right to regulate rates or charges for hydroelectric power or water uses and services where the state does not, is vicious. When a citizen of a state may not in his courts question the exercise of the legislature's discretion on any matter, this bill purports to let the United States (that is to say, let some clerk of the president) question the state legislature's discretion outside of any power of review anywhere. The authority of Great Britain's Parliament was spurned by the people of her American Colonies for less than this.

In conclusion, the trouble of the Jones bill that it should not be, is because it is predicated on the assumption of a jurisdiction of Congress which has no constitutional existence. It assumes that the Federal government has a sovereign's right of uses in the public land by which it may let or hire out the land as proposed by this bill, whereas the Federal government holds in trust, only the proprietor's title of the fee of the naked soil; the People—the individuals of the people—being the sovereign, and thus possessed of the sovereign's rights of uses. The Federal government has only the right of the naked soil—and that a title in trust for disposal. The recent dicision of the California Supreme Court in the Tide Land Cases (L. A. No. 3060) lucidly explains this title of the Federal government to the naked soil. The proposition of the Jones bill requires that the doctrine in the English law of uses vested in the sovereign head of the state, should have force to give the Federal government the crown rights of uses of the public land. But, it could only do this on the assumption that the Federal government was the head of our people—their sovereign—whereas it is the people themselves who are the head of our states. The people have vested in themselves inalienably the rights of uses of the public land to take or leave as they individually like. The federal officers who assume as agents of our government to parcel them out, for favor or money considerations, are in fact taking money from us through selling us that which is already our own—they are mere money changers in the temple of our liberties. Somewhere in this broad land there should be men big enough to throw them out.

(Signed) RUSSELL L DUNN.

ELECTRICITY AND MATTER.

A highly interesting lecture on "Electricity and Matter" was delivered by Dr. Henry S. Carhart, before a large and appreciative audience at the Pasadena Y. M. C. A. on the evening of February 19th, under the auspices of the Throop College Extension Course. The lecturer, who performed many striking experiments and showed numerous lantern slides, reviewed the work of Crookes, Hertz, Roentgen, Lodge, Currie and others who have contributed to our knowledge on discharges of electricity in high vacua. He explained the ionic theory, the effect of the discovery of radium on our conception of the constitution of matter and showed by means of slides, recent photographs taken by C. T. R. Wilson, of England, showing the tracks of electrons and alpha particles, which have now been definitely identified with the atom of helium. The paper will be reproduced in full in a future issue.

PUBLICATIONS RECEIVED.

"Steam Turbines for Electric Stations of Moderate Size," and "New Developments in Steam Turbine Engineering," booklets by Edwin D. Dreyfuss, are being distributed by Hunt, Mirk & Company, San Francisco.

Sixth Annual Report, Montana Board of Railway Commissioners for year ending November 30, 1913. The board is also ex-officio Public Service Commission of the state and all matters pertaining to the completed business of both departments are included. Copy of the report will be mailed free upon request.

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A Public Policy of Publicity

Much of the antagonistic attitude of the public, actual or artificial, has been the result of the failure of utilities to appreciate the necessity for saying, each to the other, sufficient for a mutual understanding, and the importance on their part, of being the first to speak. In this way, misrepresentation could have been counteracted in large degree.

That the public do not appreciate the inherent difficulties attending the operation of public utilities is due simply to the fact that they have not been told. And for the same reason, they do not appreciate fully the increased comfort enjoyed, the added facilities and greater conveniences consequent upon the operation of these same public utilities.

Similarly it could be pointed out to the public that invention and the consequent increased efficiency of production is a greater factor than regulation, in the reduction of rates.

Through an educational campaign of publicity the public could learn that they will be best served by allowing that corporation to earn the best dividends which provides the most complete service. This is the only basis for a "reasonable" rate of return.

It is the needed stimulus for invention and improvement, and without the promise of such reward, commission control, with all its insistence upon standards of service, efficient management and regulation of rates, will not further the interests of the public, but will rather operate in an opposite direction.

Public policy of public utilities is not therefore as important a question as the policy of the public toward the utility and the manner in which it may be cast in the right mold.

The general spirit and purpose of the utility, if it does not embody this central idea of educating the public, will prove inutile. This is true whether the utility is viewed in the light of partner, tenant, agent, or steward, and is even more so in those situations where a politically directed tendency, recognizing none of these relationships, would make of the utility a serf.

This is the tendency, too, of over-regulation, which fails to recognize the fundamental principles of the conduct of business, which, in order to be successful, must be predicated upon freedom, confidence, and a reward of endeavor commensurate to the service rendered.

The public have some tangible property in progress which it is, therefore, to their interest to stimulate, but they can only learn this to the extent that the facts are presented to them to take the place of erroneous inferences.

The education of the public, which might be termed a policy of publicity, is the theme of an article in this issue on the public policy of public utility corporations, in which the author, Mr. S. Waldo Coleman, deals with this subject in more detail.

This article inaugurates what will now be a regular department. In articles already published the situation has been so clearly stated and is now so generally accepted, that the space will from now on be devoted to remedial possibilities and effective policies.

Your Viewpoint Appreciated

From the surface of the placid pool was reflected a landscape more beautiful and more extensive than the eye could then compass of the greensward, hills and trees it mirrored. By becoming sources because of the light received and reflected by them, they were, with the aid of the pool, in turn brought to the attention of the observer, to their appreciation—otherwise not bestowed—and to his advantage.

In this issue are several letters, not necessarily published because the Journal agrees with the reader's views, for opposite ideas are expressed, but because they reflect light from different angles, upon the important subjects discussed.

The Journal is in large degree a pool of other men's minds, and it is used for reflecting the different views and viewpoints of the hydroelectric and other power and gas interests of the West.

And just as the rays falling upon an object are diffused in every direction, so light on the questions reflected from these pages may be observed from all angles, giving an equally clear and comprehensive view from each.

If we are able to reflect again the thoughts arising in the mind of the reader, our object will be furthered.

Conservation Legislation

Neither battledores or battle doers have been lacking to keep the shuttlecock of conservation legislation in the air. It was without surprise, therefore, that a despatch was received from Washington close on the heels of the waterpower bill introduced by Senator Jones, announcing what is purported to be a new conservation policy fathered by Secretary of War Garrison, and dealing with navigable streams. It looks as though an effort is now to be made that this problem be worked out by closer co-operation between the states and federal government.

As with big business, so with waterpower developers. Both are desirous of knowing just what it is necessary for them to do in order to comply with the law.

Immediate action on this question is therefore essential that the interwoven mesh of state and federal laws, and opinions, regarding waterpower development be disentangled. But the action taken should be comprehensive, covering all possible waterpower development, and at the same time protecting established interests. Only in this way can be set free the energy of the capital and brains which would more fully utilize these resources.

Suits and more suits instituted by the government charge the air as a menace to hydroelectric enterprise.

The avowed object of conservation is not to hamper, but to aid. The law should, therefore, clearly define its requirements and development enterprise should be in this way adequately protected.

In the meantime, the different waterpower measures proposed call for the active interest of all. But the day of remedial measures of temporary relief have passed. The facts which may be made available call urgently for complete disposition.

Letters from readers in this issue show somewhat the difference of opinion which exists regarding these matters, and call for careful consideration.

With the administration active and apparently anxious for the satisfactory disposal of this question, the hour is ripe for the arrangement of a Western conference with the avowed intention of framing a waterpower bill to be submitted to Congress, representing the collective opinion of the West. It is primarily the West's problem and the West should handle it.

Western Red Cedar Poles

There are several reasons why the specifications for red cedar poles are published in this issue. As data on which to base specifications for the purchase of poles, or line construction contracts, they will be found of value. An effort is now being made to have the National Electric Light Association include these in their standard specifications for overhead line construction.

The specifications proposed for adoption are those of an association interested in the sale of poles and for this reason may not entirely agree with those specifications preferred by purchasers.

At the convention of the National Electric Light Association held at New York in 1911, specifications for overhead line construction were recommended to the executive committee of the association and were later adopted. These specifications have, as far as local legal requirements will permit, become standard, and are usually adopted by member companies without question.

Although Eastern white cedar pole specifications are included, Western red cedar is not mentioned. This, though undoubtedly unintentional, works an injustice to an extensive Western industry, and it is important that steps be taken that this be remedied.

It is not sufficient to endeavor to adapt the Eastern specifications to the Western product. Western red cedar does not taper as rapidly, for example, and the butt specifications given for Eastern white cedar would be impossible of application. The clause relating to one complete twist for every twenty feet is also here unnecessary, as the Western red cedar grows in sheltered flats and canyons, with the result that there are no wind-twisted trees.

There is no reason why such specifications should be involved, provided that all possible defects are covered and the purchaser thereby protected.

The committee of the National Electric Light Association entrusted with framing the overhead line specifications did not present them as perfect. It was anticipated that they would be improved and certain additions have since been made.

There appears to be no reason, then, why the specifications published in this issue should not be also included in the N. E. L. A. specifications.

Here is an opportunity for Western members to get action and so show that their outlook is not limited to their own interests except perhaps as they are identified with the larger interests of all Western industry.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

W. R. Lyall, of the D. & W. Fuse Company, is at Vancouver, B. C.

G. Douglas Jones, state electrical engineer, was at San Francisco this week from Sacramento.

C. H. Thordarson of the Thordarson Electric Manufacturing Company, is at San Francisco.

F. N. Averill, of the Fobes Supply Company, Portland, Oregon, is a visitor at San Francisco.

H. A. Kluegel, chief engineer, Mt. Whitney Power & Electric Company, was at San Francisco this week.

A. H. Noyes, salesman in the Pacific Nortwest territory of the Electric Appliance Company, is at San Francisco.

Geo. Richardson is now chief operator of the Southern California Edison Company's No. 7 substation at Los Angeles.

Sylvester A. Baker, Pacific Coast representative, Macbeth, Evans Glass Company, is now at Spokane, Washington, on business.

H. E. Sanderson, manager of the Pacific Coast offices of the Bryant Electric Company, has returned to San Francisco from Seattle.

H. B. Kirkland, general sales manager, American Conduit Manufacturing Company, Pittsburg, Pa., is among the Eastern visitors at Los Angeles.

J. I. Colwell, manager Seatle office, Western Electric Company, is at San Francisco and will attend the convention of the Pacific Coast Jobbers at Del Monte.

L. V. Cummings, chief engineer, Thorndyke Bley Mining Company, Sunland, Nevada, is at San Francisco making purchases of machinery and electrical equipment.

H. D. Harvey, who has been traveling the Nevada territory for the Electric Appliance Company, has now joined the city sales force of that company at San Francisco.

Franklin T. Griffith, president Portland Railway, Light & Power Company, has returned to Portland, Oregon, from a trip made to New York in the interests of his company.

H. C. Goldrick, Pacific Coast manager, Kellogg Switchboard & Supply Company, left San Francisco last week for the Hawaiian Islands in the interests of his company.

F. E. Greenman, now power salesman in the Oakland District, Great Western Power Company, was previously connected with the H. M. Byllesby Company at Stockton, Cal.

P. E. Jacquet, until recently employed in the Los Angeles district office of the Southern California Edison Company, has accepted a position with the Pacific Telephone & Telegraph Company at San Francisco.

W. W. Low, president Electric Appliance Company, Chicago, IlL, expected in San Francisco about March 11th, has arranged to attend the Pacific Coast Jobbers' Convention at Del Monte.

D. H. Scranton, president of the American Electric Heater Company, who was at Los Angeles during the past week, will visit San Francisco after attending the Pacific Coast Jobbers' Convention at Del Monte.

L. L. Hunt, general sales manager, Commercial Electric Supply Company, St. Louis, has been making a combined business and pleasure trip on the Pacific Coast, is returning by way of Arizona and Colorado, stopping at interesting places en route.

R. H. Ballard, secretary and general manager, and **H. H. Trowbridge**, chief counsel, Southern California Edison Company, have returned to Los Angeles from Chicago, which trip was made to complete the necessary details for the delivery of bonds to the company's bankers.

J. E. Gale is now president of the British Columbia Association of Gas Engineers; **W. G. Campbell**, first vice-president; **R. W. Pine**, second vice-president; **F. H. Chappell**, Vancouver, B. C., secretary, and **W. Stark**, treasurer. The association is beginning its second year as an organization and has 84 members.

H. M. Jones, manager San Diego Consolidated Gas & Electric Company, is responsible for an advertising campaign to be made by H. M. Byllesby & Company in the interests of the San Diego Exposition. The company's newspaper advertising throughout the country will now carry the lines "San Diego, Exposition—All 1915—San Diego, California."

George H. Harris has been appointed general superintendent of the San Francisco-Oakland Terminal Railways, and **George H. Binkley**, chief engineer in charge of maintenance of way and structures. **Edward M. Boggs**, formerly assistant to the general manager, is made chief engineer of docks and wharves.

L. B. Cramer has been appointed electrical engineer of the San Francisco and Oakland Terminal Railways, with offices on the third floor, Syndicate Building, Oakland, Cal. Mr. Cramer has for the past four years been connected with the Oregon Electric Railway Company and the United Railroads, a subsidiary of the system, at Portland, Oregon.

C. J. Franklin, general superintendent of railways for the Portland Railway, Light & Power Company, has resigned from that position. For some time Mr. Franklin has contemplated the organization of an institution to furnish public utility companies an opportunity to employ expert service in all matters embracing operating problems, matters of construction, valuation and appraisals, projected railroads, arhitrations and rate situations, and will now engage in that profession. There is a great demand throughout the country for competent reviews of impending difficulties in the matter of operation and of service. The questions involved are largely technical and are matters which appeal directly to the owners of the properties.



Mr. Franklin will open offices in the Wilcox building, Portland, Oregon, and **H. M. Clark**, his private secretary, who has been with him since Mr. Franklin has been connected with the Portland Railway, Light & Power Company, will be associated with him.

The resignation of Mr. Franklin, which has been accepted with regrets by the management of his company, will take from the local field one of the most prominent operating officials on the Pacific Coast. He has been connected with the Portland Railway, Light & Power Company as its general superintendent for seven years. During this time he had charge of the entire operation of the railways of the company.

Previous to coming to Portland Mr. Franklin was for five years with Stone & Webster, and was located at Tacoma as general superintendent of the Tacoma Railway & Power Company and the Puget Sound Electric Railway Company, operating between Tacoma and Seattle. Mr. Franklin was brought to the Pacific Coast by Stone & Webster after he had served thirteen years with the Virginia Passenger & Power Company of Richmond, Va. He first became associated with the electric railway business in Richmond, Va., where, as a boy, he started at work in the shops. It was with this company that the first successful commercial introduction of the electric railway took place in this country, and Mr. Franklin grew up in its environments.

MEETING NOTICES.

Oregon Electrical Contractors' Association.

On the evening of February 23rd the Oregon Electrical Contractors' Association was addressed by A. C. McMicken, manager of the commercial department of the Portland, Railway, Light & Power Company. The meeting was held at the Portland Commercial Club.

San Francisco Electrical Development and Jovian League.

Tuesday, March 2d, was Jovian Day, the meeting being held, as usual, at Tait's. There was a sparse attendance, but this seemed to have a stimulating effect on those present. G. Arbegast told of business conditions at Los Angeles and of the activities of the Jovian Order there, and J. E. Colwell, of Seattle Jovian activities. F. H. Poss was chairman. Good humor prevailed, and the meeting was voted one of the best yet held.

Utah Electric Club.

At the regular luncheon held at the Commercial Club, Thursday, February 26th, J. E. Cosgriff, president of the Continental National Bank, Salt Lake City, discussed "The New Banking Law." Mr. Cosgriff declared that the enactment of the new currency measure and the income tax law will ultimately operate as a curb on the ambitions of the money kings in this country to amassing fortunes in such enormous proportions as have marked the rise of such men as Rockefeller, Carnegie, Morgan and others.

In clear and concise terms Mr. Cosgriff gave the members of the Electric Club a brief history of American banking institutions and compared them with those of European nations and pointed out how the new banking law will retain practically all of the advantages of the American decentrallized system of control and obtain practically all of the advantages of the European systems of centrallized control.

Pacific Section of the National Association of Electrical Inspectors.

This section has been organized and electrical contractors may now hope for the long desired standardization of common practice, at least in cities around San Francisco Bay. Organization was effected through the efforts of W. S. Hanbridge, secretary of the California State Electrical Contractors' Association, who arranged a noon hour meeting at the Hof Brau, San Francisco, at which eight members of several Inspection Bureaus were present. These included those elected as officers and B. C. Hill, supervisoral inspector, Oakland, Cal.; W. N. Reed, inspector, Board of Fire Underwriters of the Pacific Coast, San Francisco; W. A. Spencer, electrical superintendent, San Jose, Cal.; O. K. Jones and Mr. Kempton. The officers are C. W. Mitchell, president; Wm. G. Pennycook, vice-president; J. W. Carrell, secretary-treasurer. The address of the secretary is 55 Fulton street, San Francisco.

Seattle Jovian League.

The Seattle Jovians held their weekly luncheon at the Lincoln Hotel Friday, February 20th. Members present were much interested in a thirty minute talk by Professor Magnusson, Professor of Electricity at the University of Washington, on the merits and possibilities of the nitrogen filled lamp.

Again the following week the League met at the Hotel Lincoln Friday, February 27th, and thirty members present enjoyed a half hour talk by Elliott Higgins of the Detroit Electric Vehicle Company, on the development of the electric vehicle industry.

Alameda County Electrical Development League.

A representative gathering at the regular monthly meeting held at the Avenue Restaurant, Oakland, Cal., discussed the advantages of the League endorsing or guaranteeing the work of its members, and of advertising their names in the local newspapers and periodicals. Considerable progress was made, a committee appointed with power to take action and it is thought that some such scheme will be immediately put into effect.

D. Mosher of the new Electro-Alkaline plant at Oakland, was present and addressed the meeting. Upon request he described the products, and the range of business anticipated.

A paper on "Lighting for Profit" was then read by H. E. Grant. Upon motion duly seconded, the League requested that the paper be published in the Journal of Electricity, Power and Gas. G. B. Furniss was chairman of the meeting.

Los Angeles Section A. I. E. E.

On the evening of February 28th, many of the members of the Los Angeles Section of the A. I. E. E. journeyed to Pasadena to attend the monthly meeting which was held at the Throop College of Technology and was conducted by the Throop Students' Branch of the A. I. E. E. The meeting was opened by Chairman E. R. Northmore and after the transaction of routine business, resolutions on the death of Cecil A. Howell, superintendent of tests for the Southern California Edison Company, and Andrew W. Lindgren, electrical engineer of the Huntington Beach Utilities Company, were adopted by a rising vote. The meeting was then turned over to Chairman W. L. Newton of the Throop branch and after a few explanatory remarks by Prof. R. W. Sorenson on the aims of Throop College, the following thesis papers were read: "The Design of an Automobile Testing Plant," by H. P. Gerckens; "Experiments to Determine the Relation Between Mechanical and Magnetic Properties of Iron and Steel," by V. Morse; "Electric Equipment for Automobiles," by G. D. Young; "Experiments on Y and Delta Systems," by Walter L. Newton. The members were then shown through the splendidly equipped laboratories, classrooms and shops of the college by Dean Damon, Prof. Sorenson and others, and the students who read the above papers, explained the apparatus employed for their thesis work.

Jovial Electrical League of Southern California.

A large number of members and their friends attended the weekly luncheon at Christopher's on February 18th, to listen to a lecture on the Big Creek Power Development, by G. B. McLean of the Pacific Light & Power Company. The lecture, which was well illustrated by lantern slides, made from very recent photographs, covered every detail of power house, line and substation construction and equipment and gave the audience a clear idea of the magnitude of this important development and the obstacles which had to be surmounted.

On Wednesday, February 25th, eighty Jovians attended the luncheon, over which Jas. F. Rogan presided, and listened to a scholarly address on "Probation," by Hon. Paul J. McCormick, superior court judge. It was pointed out that while probation should not be recommended in the case of habitual or hardened criminals, it had, nevertheless, proved its worth, when judiciously administered, as it failed to accomplish its purpose in only five per cent of all cases on record in this state.

A resolution was passed urging the city council to appropriate funds to bring the city planning exhibit, now on tour through the country, to Los Angeles. A similar resolution, on motion of Geo. A. Damon, was sent to the council by the local section of the A. I. E. E. As other civic organizations have sent similar requests, a committee to further this movement has recently been formed and Chairman Colkitt has appointed Max Loewenthal to represent the Jovian League on this joint committee.

Under the guidance of the present officers the league in general is increasing, both in popularity and usefulness. The present officers are J. N. Colkitt, chairman; Thos. E. Burger, vice-chairman; J. G. Pomeroy and J. Harry Pieper, executive committee; K. E. Van Kuran, secretary-treasurer. Out of town visitors are always welcome to attend the weekly meetings.

INDUSTRIAL

INFORMATION FOR EXHIBITORS IN MACHINERY DEPARTMENT, P. P. I. E.

Free Space: There is no charge for exhibit space, but space occupied must be properly and economically utilized.

Transportation: Exhibits may be consigned directly to the space to be occupied, through the Exposition Terminal Railway Company, which will receive and transfer exhibits from the terminals of the transcontinental and steamship lines, making a charge of .15c per hundred pounds. A one-way freight charge will cover return of all exhibits over transcontinental lines to point of origin.

The Exposition Terminal Railway Company will provide at Chicago and other eastern points, warehouses to receive less than carload shipments that will be combined in carload lots and shipped direct to the Exposition, thereby securing carload rates.

Water: The Exposition will install a system of mains for furnishing water for domestic and drinking purposes within or under the Exposition's buildings and generally throughout the grounds.

All consumers must purchase water on a meter basis. The rate for water for ordinary domestic purposes will be 40 cents per thousand gallons, and rates are subject to a minimum charge.

Special rates will be given for water used for other than ordinary domestic purposes.

Electricity Lighting Service: In the Palace of Machinery the lighting will be served from 60-cycle, 3-phase mains with approximately 115 volts between conductors. Exhibit buildings will not be open at night nor Sundays.

General illumination of building will be cared for by Exposition Company.

Alternating Current Power Service: In the Palace of Machinery there will be available for power purposes, 60-cycle, single-phase and 3-phase current at approximately 230 volts.

Single-phase motors must not be over 1 h.p. in size if served at 115 volts nor over 5 h.p. if served at 230 volts.

Direct Current Power Service: Direct current at approximately 125 and 250 volts will be available in the Palace of Machinery.

Direct current will only be available during the hours that the Exposition buildings are open to the public. No direct current will be furnished for motors or apparatus of larger capacity than 25 h.p. and no motor larger than 2 h.p. will be served with 125 volt d.c., unless arranged for in advance under special contract. As the amount of direct current is limited exhibitors requiring same must request the amount they need as early as possible.

Special Rates: Exhibitors requiring electric service to operate moving machinery for exhibit purposes will be charged only for the energy used at the rate of 3 cents per kw.-hr.

Gas Meter Rates: The rates for gas supplied to consumer during each calendar month or fraction thereof, and as measured by the meter installed by the Exposition, will be as follows:

$1.00 per 1000 cu. ft. for the consumption in each month up to and including 50,000 cu. ft.

$0.80 per 1000 cu. ft. for the excess consumption in each month over 50,000 cu. ft.

The minimum bill per month will be as follows:

For installations having a	¾ in. meter	$2.50
" " "	1 in. meter	5.00
" " "	1¼ in. meter	7.50
" " "	1½ in. meter	10.00
" " "	2 in. meter	15.00

Steam Service: Steam service will be available in the Machinery Building during the hours that the building is open to the public. Saturated steam at a pressure of approximately 150 lb. per sq. in. will be furnished. Headers and mains for live steam, exhaust steam, drips and drains will be installed by the Exposition. Participants requiring steam must arrange for service in advance.

Steam will be sold to exhibitors at approximately actual cost to the Exposition Company. The rates will be fixed as soon as the various elements of cost have been determined.

Compressed Air Service: A limited amount of compressed air at 80 lb. per sq. in. will be available in the Palace of Machinery. Compressed air service must be arranged for in advance.

The consumer shall pay for compressed air service a monthly charge of $4.00 per. h.p. of maximum demand of his installation, and in addition thereto $0.15 per 1000 cu. ft. of free air consumed. One h.p. will be considered equivalent to 5.5 cu. ft. of free air used per minute.

Crane Service: The main bays of the Machinery Palace will be served by electric, overhead traveling cranes. Two 30 ton cranes will travel the center bay and one 20 ton in each of the outside bays.

Exhibitors may obtain crane service for erection purposes, if needed, at a moderate rate.

Exposition Service: Working exhibits that are able to furnish part of Exposition requirements will be compensated at regular rates.

Building Details: The floor of the building is designed to carry a load of 200 pounds per sq. ft. and consists of two-inch plank on joists carried by mud-sills. The machinery building is located on ground well adapted for foundations. There will be no line shafting in the building.

The clear head room, below rails of traveling crane, of the three central bays is 50 ft. The wing bays have a clear head room of 40 ft.

Adjacent to the main building is located the "Gas and Fuels" Building, in which will be placed operating exhibits of boilers, steam hammers, gas producers, and other appliances in operation which by reason of noise or for other causes should be excluded from the main building.

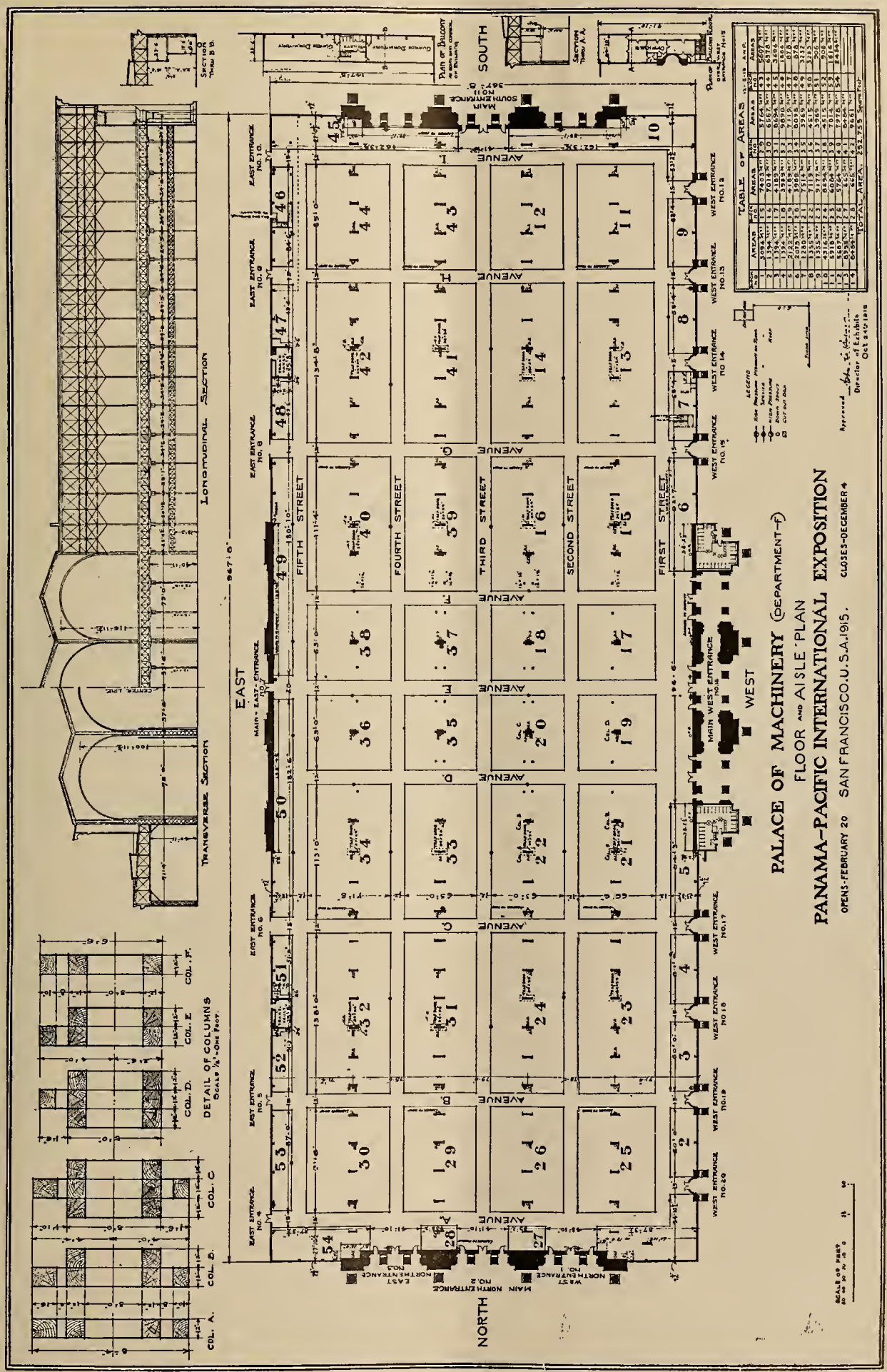
Space Application: Applications for exhibit space will be given precedence according to date of receipt.

At the present time it is only necessary for the applicant to state approximate amount of space desired. Detailed plans showing arrangements of exhibits can be sent in later when the final allotments of space are made

The official classification shows in which Palace the exhibit should be installed, and separate application is necessary for each exhibit department.

Combined Exhibits: Exhibitors who do not feel justified in the expense of independent exhibit, may collect their allotted space so that the expense of attendant or attendants may be proportioned among the different manufacturers. Each exhibitor must sign an application and his exhibit will be reviewed individually by the jury of awards. Further information on request.

The Palace of Machinery is the largest building erected on the Exposition site. It is 968 by 368 ft. One mile and a half of cornices were used in ornamenting the building. Four carloads of nails and fifteen hundred tons of steel (bolts and washers) were used in its construction. The numerous arched trusses supporting the lofty roof of this building are above the three longitudinal naves and have a span of 75 ft. placed above the three longitudinal naves and have a span of 75 ft


PALACE OF MACHINERY (DEPARTMENT F)
FLOOR AND AISLE PLAN
PANAMA-PACIFIC INTERNATIONAL EXPOSITION
OPENS-FEBRUARY 20 SAN FRANCISCO.U.S.A.1915. CLOSES-DECEMBER 4
EAST
WEST
NORTH
SOUTH
FIRST STREET
SECOND STREET
THIRD STREET
FOURTH STREET
FIFTH STREET
AVENUE A
AVENUE B
AVENUE C
AVENUE D
AVENUE E
AVENUE F
AVENUE G
AVENUE H
Longitudinal Section
Transverse Section
DETAIL OF COLUMNS
TABLE OF AREAS
TOTAL AREA, 261,755 Square Feet

INTERNATIONAL ELECTRICAL CONGRESS, 1915.

The forthcoming congress is to be held in conjunction with the Panama-Pacific International Exposition, San Francisco 1915. This Exposition is to celebrate in a fitting manner the completion and opening of the Panama Canal. As this crowning achievement of science and engineering is certain to attract many engineers to the Canal and to the Exposition, it was early recognized that conditions would be propitious for convening electrical engineers of all countries in a congress in which the international feature would be unusually prominent. Accordingly, the American delegates to the most recent congress, that of Turin in 1911, extended an invitation to the congress to meet in San Francisco in 1915. This invitation was accepted, the necessary authority was granted by the International Electrotechnical Commission, and under the auspices of the American Institute of Electrical Engineers plans for the congress have been effected and the organization work is being prosecuted vigorously.

It is the desire of the committee on organization that engineers the world over shall promote and participate in the success of this congress. To that end the committee pledges its utmost effort in the organization of the congress and in making its valuable transactions available to members upon the most attractive terms practicable, and the committee calls upon the electrical engineering profession for assistance and support in its undertaking.

One purpose of the forthcoming congress is to bring together in San Francisco a large and representative body of electrical engineers from all over the world who shall find interest and inspiration in the congress, in the Panama-Pacific International Exposition and in the celebration of the completion of the American interoceanic canal. A second purpose is to erect in its published transactions a notable milestone of electrical engineering progress and development as a permanent record of contemperaneous electrotechnical achievement.

The membership of the memorable St. Louis congress in 1904 was over 2000 and the transactions included 150 papers with discussions. The immense growth of the electrical industry and the rapid progress of electrical science during the past decade justify expectation of a much larger membership and of greatly enlarged and even more authoritative and useful proceedings. The published transactions which are expected to constitute a very valuable addition to the literature of the art will be available to members at such a low price that either in part or as complete sets they will be within reach of all. Those who may be unable to attend the congress may find a large measure of participation through possession of the transactions.

Manuscripts will be received and papers will be printed in English, French, German, Spanish and Italian. All papers printed in languages other than English will be accompanied by English abstracts.

Invitations are now being issued to engineers in all civilized countries to prepare papers for the congress, and the committee on program will be glad to consider any papers which may be offered, acceptance of such papers, however, being contingent upon the usual considerations and upon the space limitations of the transactions.

The committee has chosen to make the membership fee and the cost of transactions to members as low as possible, depending upon the electrical engineering profession to support the congress generally by means of the large membership which is essential if the congress is to be self-supporting and if the transactions are to be made available to members at a low price.

Accordingly the committee on organization extends to all engineers who are affiliated with engineering and scientific societies of standing, an invitation to apply for membership in the International Electrical Congress.

A large number of the foremost and best known electrical engineers of the world are identified with the congress and many have signified their intention of being present at the meetings. The committee urges you to fill out a membership application, and to plan to be present in 1915.

The membership fee is $5 (New York Exchange) which entitles the member to the privileges of the congress, to the general index, and to a choice of any four of the Section Volumes of the Transactions. By payment of $1 the volumes ordered will be delivered without further expense. By an additional payment of 50 cents a volume they will be delivered bound in cloth. Additional volumes may be had at $1 each, bound in paper, or at $1.50 each, bound in cloth, and the entire set of 13 volumes (probably) will be delivered for $11, if bound in paper, or for $16 if bound in cloth.

The meetings of the 1915 congress will be divided into twelve sections and the volumes in the complete set are expected to be as follows:

1. **Generation, Transmission and Distribution.** Central station and substation design, control and operation. Long distance transmission of electric power.
2. **Apparatus Design.** Generators, motors and transformers. The rating of machinery.
3. **Electric Traction and Transportation.** City, surface and rapid transit railways; interurban and trunk lines; electric vehicles, ship propulsion, mining railways, elevators, and hoists.
4. **Electric Power for Industrial and Domestic Use.** Factories, mills, refrigeration, heating devices, etc.
5. **Lighting and Illumination.** Arc and incandescent lighting; the science and art of illumination.
6. **Protective Devices: Transients.** Switches, circuit breakers, condensers; electrostatics; disruptive phenomena; high-frequency phenomena.
7. **Electrochemistry and Electrometallurgy.** Electrolytic and metallurgical apparatus and processes.
8. **Telegraphy and Telephony.** (a) All communication of intelligence by the use of wires. (b) Electromagnetic waves and radio-telegraphy and -telephony.
9. **Electrical Instruments and Electrical Measurements.** Switchboard, portable, standard and absolute instruments. Testing and standardization methods; absolute measurements.
10. **Central Station Economics.** Load factors, power factors, measurement of maximum demand and all problems affecting the economy of central stations; also rates, their regulation and legislation.
11. **Electrophysics.** Radioactivity; Rontgen rays; gas and vapor conduction; electron theory; constitution of matter, etc.
12. **Miscellaneous.** Such as history and literature of electrical engineering symbols and nomenclature; engineering education and ethics.
13. **General Volume and Index.**

IDAHO PUBLIC UTILITIES COMMISSION.

The Lewiston-Clarkston Improvement Company of Clarkston, Washington, through its vice-president, Robert A. Foster, filed with the commission its application to publish at less than statutory notice, a supplement to its Schedule No. 1, constituting a material reduction in rates. The permission was granted and the new schedule is now in effect.

The Pocatello Gas & Power Company, Pocatello, Idaho, was given permission to make certain minor changes in its schedule and to collect a deposit of $3 from each customer. The company agrees to pay interest on these deposits at 8 per cent per annum.

TRADE NOTES.

The San Rafael city council awarded the contract for the erection in concrete base of 97 electrolier posts on Fourth street from Tamalpais avenue to E street, and the installation of an underground conduit system to the Pacific Fire Extinguisher Company at $14,165.

The State Prison at San Quentin, California, is being electrically equipped throughout, electric motors being used to replace group drive. This work represents an expenditure of $25,000 and will include placing the entire mechanical equipment on a higher efficiency basis. This work is under the direction of G. Douglas Jones, state electrical engineer.

NEWS NOTES

INCORPORATIONS.

MODESTO, CAL.—Oakdale Gas Company, $75,000, shares $1 each, subscribed $50, by J. R., M. M. and G. W. Anderson.

MEADOWDALE, WASH.—Sound Telephone & Telegraph Company, $5000, incorporated by W. P. and J. R. Cleaveland and Louis Andrews.

GLOBE, ARIZ.—Articles of incorporation have been filed by Hes. B. Ryan, Chas. W. Gift Jr. and Richard West, for the Globe & Miami Traction Company, capitalized for $250,000. The general nature of the proposed business is to furnish, transmit and deliver sounds, signals, mail matter, freight, general merchandise, light, heat and power, to operate a telephone system, a telegraph system and an electric railway, etc.

ILLUMINATION.

WALKERVILLE, MONT.—The city council has accepted a new lighting contract with the Montana Power Company.

KLAMATH FALLS, ORE.—Plans are being developed here for a municipal power plant. Attention will be directed to the feasibility of developing power through the medium of the Keno ditch.

EUREKA, CAL.—Improvements are being planned for the Humboldt system of the Western States Gas & Electric Company, it being estimated that over $70,000 will be spent here during the next twelve months.

GLENDALE, CAL.—The electric light department of this city has announced a reduction in electric light rates effective March 1st. The new schedule will be: For the first 20 kw.-hr., 7 cents per kw.-hr.; for the next 14 kw.-hr., 6 cents, and 3 cents per kw.-hr. for all in excess. There is a monthly minimum of 50 cents.

RIVERSIDE, CAL.—Sealed bids will be received up to March 18th, by the Board of Supervisors, Riverside County, for a franchise granting the right to construct and operate a system of wires for transmitting electrical energy for light, heat and power purposes, along public roads in Riverside County, the franchise to run for 50 years.

LOS ANGELES, CAL.—Lower electric rates are promised consumers by the Pacific Light & Power Corporation and the Southern California Edison Company in applications filed with the State Railroad Commission for permission to take over certain southland plants. The Pacific Light & Power Corporation proposes to take over two plants at San Fernando, another at Compton, and still another at Glendora; the Southern California Edison one at San Fernando.

OGDEN, UTAH.—The city commissioners have reached a satisfactory agreement with the Utah Power & Light Company relative to the equipment and current necessary, and have authorized the Mayor and Recorder to enter into a contract with them for the extension of the White Way Lighting system on Twenty-fifth street between Washington and Adams avenue. The system as at present installed consists of the General Electric 4 amp. d.c. luminous inverted type arc lamp adapted to a decorative bracket mounted on the steel poles carrying the suspension wires for the trolley system of the Ogden Rapid Transit Company. P. M. Parry, manager of the lighting company announces that the arc lamps will be installed at an early date. The Weber Club have a committee appointed to work on further extension on this system to all of the principal business streets of Ogden.

TRANSMISSION.

SAN FRANCISCO, CAL.—For the first time since its completion, four years ago, the power lake of the San Joaquin Light & Power Company at Crane Valley is full, the water being at a record height of 106 ft.

NEWPORT, ORE.—The Newport electric light plant has been purchased from J. D. Hewitt of Tacoma, and Seymour H. Bell of Portland, by A. Welch, railroad builder and capitalist and promoter. A new engine and new boilers will be installed.

GLENDIVE, MONT.—The Glendive Heat, Light & Power Company has announced that a new hydroelectric power plant, representing an investment of $75,000 will be constructed next spring near the Yellowstone River. The building will be two stories high and will be built of concrete and brick.

SOUTH BEND, WASH.—Frank MacKean of Seattle has filed water appropriation rights on the South Fork River and has closed negotiations with owners of property along the river for the development of Willapa Harbor and South Bend. A big hydroelectric plant will be built, and when the deal is closed the company will control 2000 acres of land which will be placed at the disposal of colonists.

FRESNO, CAL.—For the purpose of insuring continuity of service the 241 mile aluminum transmission line between Big Creek and Los Angeles is being duplicated through the rough portion of the route. This additional line is to cover only the mountainous sections, as it is not figured that breaks are so likely to occur over the plains. The second line will be entirely separate, supported by its own steel towers, and will parallel the original line.

SALT LAKE CITY, UTAH.—The Utah Light & Railway Company are now engaged in installing a 1500 kw. motor-generator set at the West Temple Street substation for supplying 600 volt direct current to their railway system. This additional direct current transforming capacity has been made necessary by the addition of 24 new cars operating over the city system which supplies service on the interurban lines to Holliday and Bountiful recently put into operation.

ALBUQUERQUE, N. M.—Col. John Borradaile has presented to the city council a project of harnessing the waters of the Rio Grande at White Rock canyon for furnishing power for light and other purposes. The cost of construction of the power project is estimated at $400,000, and for an additional $400,000 the project could be made to include a water plant for Albuquerque. The J. G. White Engineering Corporation, construction engineers, will take up the project in a promotion capacity provided they are assured Albuquerque and tributary territory will subscribe to one-fourth of the stock of the company which they would organize.

SACRAMENTO, CAL.—Through an application to the state conservation commission, and by the statement of C. H. McKendree of Lakeview, Ore., a power project by harnessing the waters of Fall River in Shasta county is revealed. Incidentally the conservation commission will be called on to decide a novel point involving the disposition of power generated on a California waterway in the neighboring states of Oregon and Nevada. McKendree, who is connected with a Lakeview power concern, filed application for permission to divert a flow of 1500 cu. ft. of water per second, capable of generating 48,000 h.p. Fall River is a tributary of the Pitt, which, in turn, flows into the Sacramento. The surrounding country, including a large section of southeastern Oregon, is susceptible of irrigation, and the assumption

is that McKendree and his associates intend to engage in operations of the largest kind, furnishing power to sawmills, stock farms and irrigated farms.

LOS ANGELES, CAL.—As the result of the rejection of the city's proposition to the power corporations for the leasing of their distributing systems, with an option to purchase within five years, the council will probably call the power bond election at once. The corporations recently rejected the city's offer, and asked for further time to submit an alternative plan. Municipal ownership of the power systems is the rock upon which the negotiations were split. It was made apparent to the council committee that the corporations would not consent to the city's acquiring the power systems. Councilman Betkouski, chairman of the power committee, has announced that it is the committee's intention at once to introduce a report to the council recommending the calling of a bond election to vote $6,500,000 in bonds to complete the aqueduct power plant, and to acquire a distributing system. The next step will be to call upon the state railroad commission to condemn the distributing systems for the city's use.

TRANSPORTATION.

SEATTLE, WASH.—Actual work on the reconstruction of the Highland Park & Lake Burien Street Railway has been undertaken at the Seattle end of the line.

CHICO, CAL.—The Northern Electric Railway Company is preparing to move its auditor's office from this city to Sacramento.

PHOENIX, ARIZ.—The Phoenix Street Railway Company has made application for extension of its lines down East Washington street, a distance of about ¼ mile. Construction on the proposed line will begin immediately.

LOS ANGELES, CAL.—The Pacific Electric Company is contemplating building an interurban line into Riverside county, the line to leave the San Bernardino line at Fontana, reaching Riverside by way of Bloomington, covering a distance of four miles.

TACOMA, WASH.—Announcement has been made by officials of the Oregon-Washington Railway & Navigation Company that between five and six million dollars has been authorized by the directors of the Union Pacific system to be expended for improvements on the company's lines in Washington and Oregon.

SEATTLE, WASH.—The Puget Sound Traction, Light & Power Company has been granted permission to file a tariff showing sharp reductions in practically all freight rates between Seattle and Tacoma. This new tariff indicates that the interurban lines will enter into sharp competition with boats on Puget Sound for Seattle and Tacoma freight business.

SALT LAKE CITY, UTAH.—The Utah Light & Railway Company announces that it will extend its interurban line into Davis county from Centerville on to Farmington, a distance of five miles, during the coming year, and that ultimately the line will be continued through to Ogden. The completion of this line to Ogden will give the intervening territory in Davis and Salt Lake counties two steam lines and two interurban electric lines.

SACRAMENTO, CAL.—The Oakland, Antioch & Eastern Railway has made traffic arrangements with all the transcontinental roads which reach Sacramento. These arrangements, which go into effect on March 15, provide for an interchange of shipments between the Santa Fe, Union Pacific, Southern Pacific and Western Pacific and the O. A. & E. and through tariffs have been provided for such shipments to those points served exclusively by the electric road.

SAN FRANCISCO, CAL.—The total accumulated earnings of the Geary Street Municipal Railway now amount to $263,240. This is what the road has earned after paying all operating expenses since it first began business in December, 1912. There will be a large balance left after payment of other charges, such as interest and bond redemption. The total gross receipts to the end of January were $497,703. The total expenses were $234,462. The receipts for January amounted to $53,644 and the expenses $25,134.04. The Union street line since it same into possession of the city shows earnings just about half of the Geary street line.

SAN FRANCISCO, CAL.—Further consideration of the question of how best to relieve congested traffic conditions at the foot of Market street was taken by the supervisors a few days ago. The same arguments and suggestions made at the conference last week were again discussed, and at the conclusion of the debate the city was no nearer a solution of the problem than before. City Engineer O'Shaughnessy had modified his plans for an elevated loop, starting the incline in the center of Market street instead of at both curbs. He stated that his method of relief could be constructed at a cost of $300,000 and completed in seven months. J. J. Dwyer of the Harbor Commission declared the loop could not be constructed as speedily as the city engineer figured and that its cost, including damages to the Ferry building and Market street property would reach close to $1,000,000. The whole subject matter was finally left in the hands of the public utilities and streets committee of the supervisors.

SAN FRANCISCO, CAL.—The city engineer's office announces that the construction of the Municipal Railway on Van Ness avenue and Chestnut street will probably be started earlier than anticipated. The commencement of work on these two lines was set for April 15th, but as the materials have begun to arrive and the plans are ready, the intention now is to get bids for construction without delay, and it is expected that work will be under way before April 1st. A carload of track specials has arrived from the East, this being the first shipment under the contract, and will be unloaded at the city yard on Sixth and Hubbell streets. The first shipment of steel rails from the East is to arrive this week. At the yard there are already 11,000 redwood ties, a California product furnished under contract. The Van Ness avenue and Chestnut street lines will be among the chief means of transportation to the Exposition grounds, and the city engineer's office now believes that cars will be running on them in June.

TELEPHONE AND TELEGRAPH.

IMPERIAL. CAL.—The Imperial Telephone Company has been awarded the contract by the city trustees for the installation of a telephone fire alarm system.

BAY CITY, ORE.—At a meeting of the Nehalem Telephone & Telegraph Company held the first of the month, no definite action was taken, but it is generally conceded that Wheeler will soon have an independent line to meet up with Nehalem and other valley points.

WATERWORKS.

ORENCO, ORE.—At a recent election the people of this place decided to issue bonds for a municipal water system.

NORTH BEND, WASH.—An ordinance has been passed providing for condemning, purchasing and maintaining a system of waterworks for the town of Snoqualmie.

ALBUQUERQUE, N. M.—The city council has voted to discharge the citizens' water commission, and to drop all consideration of the city's water supply until after the April municipal election.

UMATILLA, ORE.—At the election held here February 16th bonds were voted in the sum of $20,000. The proceeds will be used for the construction of a water system for which plans and specifications have been submitted by Louis C. Kelsey.

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ELECTRICAL PRECIPITATION OF CEMENT DUST.
BY PHILIP S. TAYLOR.

ELECTRIC SMELTING OF ORES AND METALS.

IRRIGATION PUMPING WITH ELECTRIC POWER.
BY H. F. McPHAILL.

LIGHTING INSTALLATION PROGRESS P. P. I. E.

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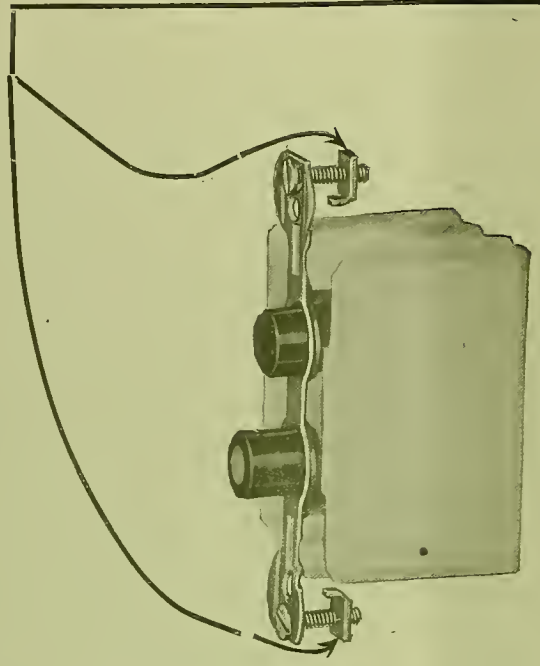
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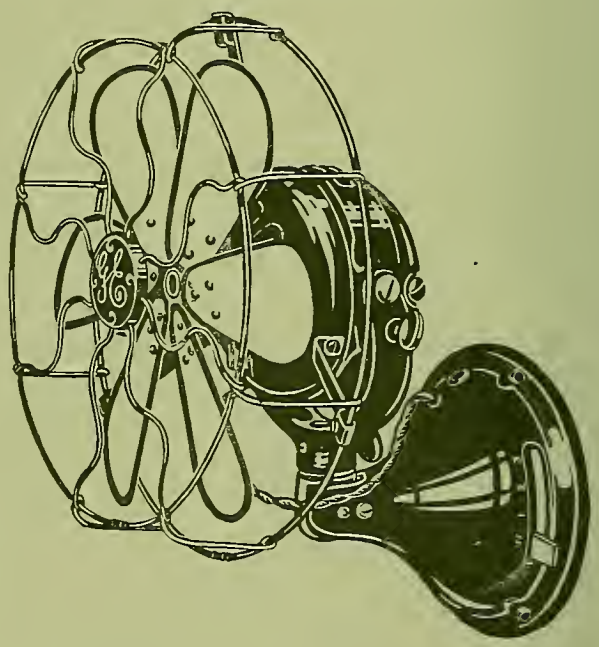
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ELECTRICAL PRECIPITATION OF CEMENT DUST

BY PHILIP S. TAYLOR.

(In this article is described a process of collecting, by means of high voltage unidirectional current, dust caused through the operation of rotary cement kilns which would otherwise escape and do damage to the surrounding country. The discussion, which is also included, gives added value, especially from a historical standpoint. The article was presented by Mr. Taylor before a recent meeting of the Los Angeles Section, A. I. E. E.—The Editors.)

This paper will deal with the collecting of dust escaping to the atmosphere from rotary cement kilns by means of the Cottrell precipitation system as applied at the works of the Riverside Portland Cement Company at Riverside, California.

Portland cement as manufactured at Riverside is a combination of lime-stone and clay materials ground to extreme fineness, usually so fine that 95 per cent will pass a sieve having 10,000 openings to the sq. in. This material is dry and in this condition is fed into the upper end of a rotary kiln at the rate of about 200 lb. per minute.

These kilns are 100 ft. long, eight feet in diameter and set at an angle of three-fourths of an inch to the foot. Fire, using crude oil for fuel, is applied at the opposite end of the kiln. The kilns are mounted upon trunions and rotate about one complete turn in every four minutes.

The materials in transit through the kiln meet the heat from the fire when at the proper time and heat—a chemical reaction takes place, the material sinters and clinker is produced. The combustion gases from each kiln equal an average of about 70,000 cu. ft. per min. at a temperature of about 550 degrees C. These gases carry some of the partially calcined material in suspension.

Early in 1909 investigation was started to determine a method of controlling the escaping dust and after carefully looking into various schemes which did not result in any practical solution of the problem, the services of Mr. Walter A. Schmidt were secured to conduct a series of investigations to adapt the Cottrell system to collect the material which was escaping.

The problem, therefore, was to take gases at a temperature of upwards of 500 degrees C. and in quantity upwards of 70,000 cu. ft. per min. from each kiln, free these gases from dust, retain the dust for use and not interfere with the output of the kiln.

The system as developed after two years of almost unceasing work on the part of the investigators, consists of treating chambers, one on each side of each kiln stack. These chambers are 13 ft. wide 18 ft. high and 38 ft. long. In these chambers are arranged the discharge electrodes and the collecting plates. From the discharge electrodes to the collecting plates a high voltage unidirectional current is maintained, setting up a strong electrical field.

To obtain this high voltage unidirectional discharge, current from a motor driven alternating current generator is stepped up from 220 to 60,000 volts and then by means of a rectifier, designed specially for this work, and driven from the same shaft that drives the generator, the current is changed from alternating to unidirectional. This rectified current has a mean value in the treaters of about 37,500 volts.

The underlying principle upon which the system

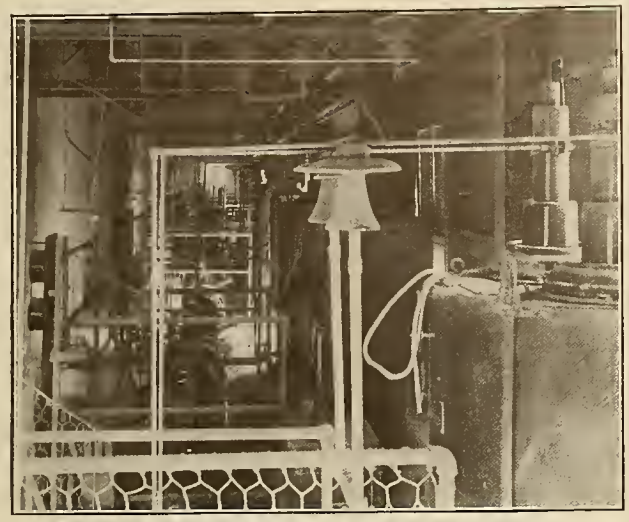


General View Showing Exit Gases Before Treaters Were Installed.



Same View Showing Small Amount of Exit Gases After Treaters Were Installed.

is based consists of bringing the dust laden gases into an electrically charged field which is maintained by means of a negative silent or glow discharge. On account of this discharge, the path through which the



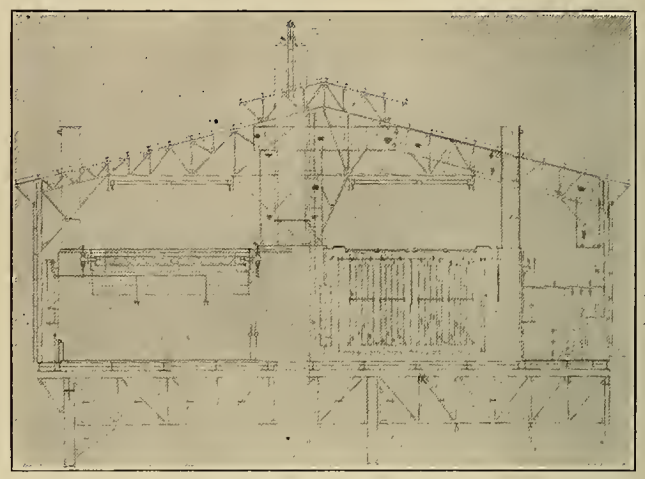
View of Rectifier Room.

dust charged gases travel becomes filled with gaseous ions and the dust particles in transit through this space become charged by coming in contact with these ions. These particles then travel in the direction of the field and are deposited upon the collecting plates. Thus the dust is drawn out of the gases and the gases themselves go on their way without hindrance.

This entire installation is made at the top of the kiln stacks, eighty feet from the ground and consists of twenty chambers or treaters, two to each stack. At the entrance to each chamber are arranged dampers which are controlled by air cylinders. Dampers are also provided at the exit. Once each hour these dampers are closed and the collecting plates thoroughly cleaned by shaking, which is done by means of air hammers which are connected to the plates. The material which is shaken from the plates is collected in hoppers from which it is taken by means of screw conveyors to its individual automatic weighing machine where the weight is recorded.

The discharge electrodes consist of No. 20 B. w. g. soft Norway iron wire and are suspended from a frame which is mounted on four sets of insulators, one set at each corner which consist of a natural stone from Catalina Island. This material is a serpentine and has the property of being a very fine insulator at high temperature. It also has the added quality of having great strength. The openings through which the high tension system frames pass, are also closed with the same material.

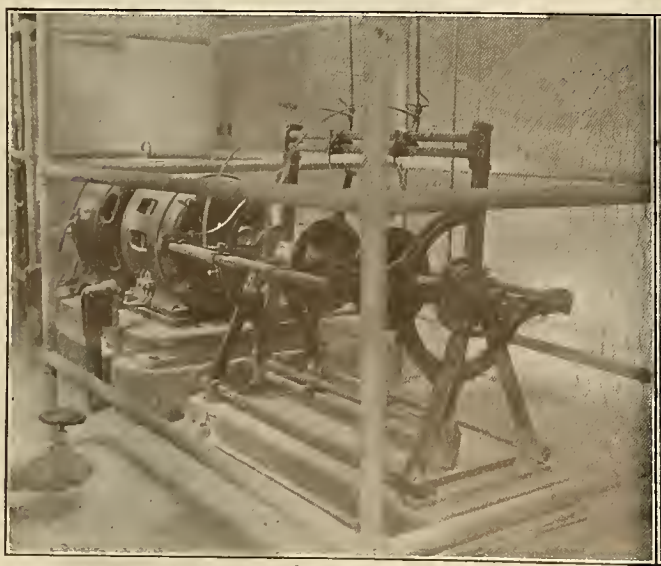
The collecting plates are made of wire screen of eight mesh number 14 wire reinforced every foot with one inch by one inch angles. These plates are spaced one foot apart and are placed longitudinally with the treater. The discharge electrodes are in turn placed between these plates and are also spaced one foot apart, thus giving a series of discharge points to every foot square of the chamber.



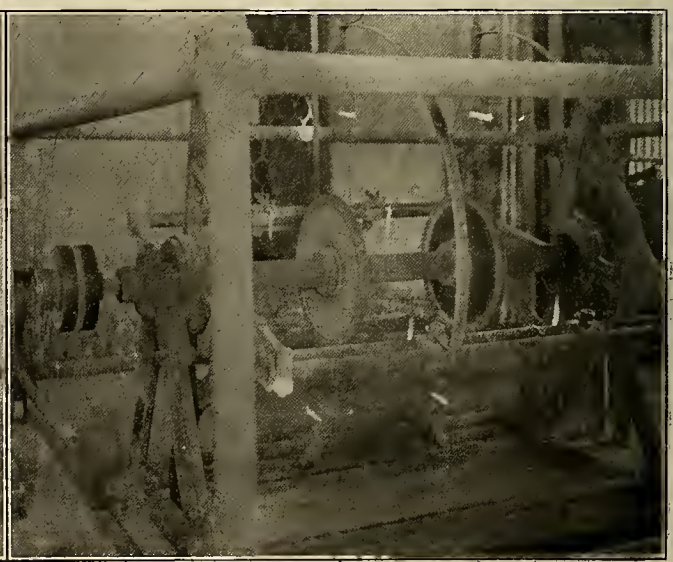
Section Through Treater.

Some dust adheres to the discharge electrodes. This is shaken off each hour by means of a few light blows with an insulated hammer on the suspension frame.

The gases enter the chamber without any previous cooling at a temperature of about 550 degrees C. In passing through the chamber the velocity is reduced to about ten feet per second and the gases lose about one-half of their heat, the exit gases having a temperature of about 250 degrees C.



Motor Generator Set and Rectifier at Rest.



Rectifier in Motion. Note the Sparks.

The amount of current to operate the system varies from 3½ to 4 kw. per treater. This includes all the power required to drive the motor-generator and conveyor.

The labor of operating is easily taken care of by two operators on a shift. There are two shifts daily.

The material reclaimed is in condition to be returned to the kiln bins and used for making clinker.

It has been found, however, that owing to the alkali content of the clay used, that the materials have considerable value as a fertilzer and large quantities have been used for that purpose.

Tests for efficiency have been made, using three methods and over long periods, the results of which have shown an average clearance of upwards of 97 per cent. A large part of the small portion which escapes is undoubtedly volatilized potash which does not condense until it reaches the cool air.

The system has been in continuous operation since January 8, 1913, with no interruption nor does it show any signs of deterioration. The application of the system has in no way interfered with the operation of the rotary kilns, in fact it has resulted in putting the control of the kiln in a more flexible condition than before. Natural draft is used and is controlled by means of the dampers into the precipitation chambers.

In order to accurately measure the effective potential in the treaters, a guard ring electrometer was developed which reads the unidirectional current potential direct, without the use of any shunts or resistances. This is an interesting instrument and is here illustrated.

It has been observed in the operation of the system that as the gases increase in temperature, their dielectric strength increases; that is, the higher the temperature the greater the potential required to maintain a given amount of current flow through the gases. This is in opposition to the findings of Prof. Ryan in his work on the dielectric strength of gases. In these gases the critical point for corona discharge seems to be reached at about 20,000 to 22,000 volts.

A rather curious phenomena appears in the outlet gases as they make their exit. A considerable charge is retained and by exploring with a conductor and a static voltmeter, this charge appears to have a value of about 10,000 volts.



Gang Ring Voltmeter.

For the purpose of protecting the structure from excessive temperature, thermo-electric couples are placed in the gases in the stacks. These couples, by means of a delicate galvanometer and pen, make a continuous graphic record of the temperature of the gases.

From the results obtained and maintained for the past year, it would appear that the materials recovered would about make the system self-sustaining and that a very difficult problem has been satisfactorily solved.

DISCUSSION.

Harris J. Ryan (by letter): I am glad to have had this opportunity to read Mr. Phillip S. Taylor's interesting and valuable paper. I have to place this note of comment and copy of his paper in the mail within the hour of its receipt. I can refer, therefore, only to the point the author makes in regard to the conduction of the dust laden gases in relation to voltage and temperature.

The author has found that increased voltage is required to maintain a given current through the dust laden gases at increased temperature. Such result is undoubtedly correct. His knowledge of these matters and facilities for studying them enable him assuredly to arrive at correct results.

Such result, is, however, not at all in conflict with the results found by me and authenticated by Watson Peak and Whitehead, viz: that the voltage required to short conduction in the normal comparatively dust-free atmosphere diminishes as the temperature of the air increases. From such result one can not predict, however, the relation between the temperature of a dust laden gas and the voltage required to maintain a given amount of discharge current through such gas. One could not even predict, with a certainty, that the voltage which maintains a given discharge current should increase or decrease with increase of temperature. Nevertheless these matters are related all around. In the dust conduction case the factors are numerous and many of them not well understood, while in the short-of-condition in an ordinarily clean gas the factors are few and their relation well understood. Mr. Taylor's observations are new and of value, though not in conflict of our well authenticated understanding of the relation of critical corona voltage to temperature.

Walter A. Schmidt: There is so little in Mr. Taylor's paper which required comments from me, that when asked to take part in the discussion of the paper, I insisted that there is nothing of value that I could add to Mr. Taylor's own discussion of the technical questions. He and I worked together upon the entire investigations conducted at the factory of the Riverside Portland Cement Company, and Mr. Taylor is quite as familiar with all of the details of this work as I am. I did promise, however, to tell of a few of the more recent applications of the processes, provided this would be of interest to the members of the Society.

The facts as presented by Mr. Taylor are not directly in conformity with the results of investigations carried on by other investigators. The letter which has been received from Prof. Ryan, and which was read a few moments ago, shows clearly that in the investigations which were carried on in our work, we dealt with conditions not exactly comparable with those under which Prof. Ryan and other investigators conducted their measurements. The phenomena which Mr. Taylor speaks of in his paper is the result of two independent factors:

1st: The change in dielectric strength of the gases with a change in temperature.

2d: The effect of introducing particles into the field.

With a clean gas the dielectric strength of the gases decreases with a rise in temperature. The introduction of particles, however, brings about an opposite effect. Through the electrical charge which these particles assume, the introduction of a large number into the space between the electrodes instantly changes the characteristics of the field, bringing about what might be called a "banking up" effect. This results in a decrease in the field intensity at the surface of the discharge electrode with a resultant decrease in ionization, and an apparent increase in the dielectrical strength of the gases themselves. We have made no exact measurement of this phenomena as it is rather a difficult question to deal with experimentally. We are planning, how-

ever, to carry through a systematic investigation of this phenomena in our laboratories within the near future. The facts as presented by Mr. Taylor are not to be taken as evidence in opposition to the investigations carried on by Prof. Ryan and other investigators, but they well illustrate how the changing of one factor in a composite phenomena often changes all of the characteristics of the phenomena itself.

A brief review of the development of the electrical precipitation processes may be of interest to you gentlemen. The fundamentals of these processes are not entirely new. The first actual work upon this method of removing suspended particles from gases, and of which we have any record, was conducted by Sir Oliver Lodge in the early '80's. He conducted extensive laboratory investigations and definitely showed the possibilities which this method of cleaning gases possesses. He later attempted to apply the idea upon a commercial scale and conducted with his co-workers, a series of tests in the flues of a lead works. In these the discharge electrodes consisted of barbed wires. The experiments, however, proved a complete failure. It is undoubtedly true that the main reason for failure was due to the inadequate electrical generating apparatus available at that time. All the experiments were conducted with Wimshurst machines, which, although capable of producing the required potential, were unable to supply sufficient power to bring about an adequate discharge from an extensive system of electrodes. About the same time that Sir Oliver Lodge carried on his investigations in England, Dr. Karl Moller conducted similar investigations independently in Germany. The results of Dr. Moller's investigations also proved futile.

It seems that no further work was done along these lines, after the early investigations, until 1906, when Dr. F. G. Cottrell was investigating methods and processes for the purification of sulphuric acid gases, in connection with the contact processes for the manufacture of sulphuric acid. He soon devised means for generating the high potential direct current required for this work. The first commercial work was done at about 10,000 volts, at which time the main problem consisted in developing the various forms of electrodes required to bring about an adequate discharge using this comparative low potential. The general question of treater design, the development of methods and means for collecting and holding the precipitated material, necessarily presented all the worries and vexations incident of the development of any new process. The first commercial application of the processes was the collection of sulphuric acid mist. The first commercial installation was made in 1907, and this plant has been in continuous operation ever since. From this early work the application spread from one thing to another, covering the general range of sulphuric acid laden gases as encountered in metallurgical plants, the general collection of flue dust, etc. It was not until 1910 that the question of collecting cement dust was brought to our attention. Here we encountered absolutely new conditions, consisting primarily in the high temperature of the gases, the complete dryness of gases and the large quantities of non-conducting dust which had to be collected and disposed of.

Since the first experiments conducted by Dr. Cottrell the generation of high potential direct current has been continually extended to higher values. The installation at Riverside operates at approximately 40,000 volts, and the last work which we have conducted in the metallurgical plants was with direct current at a potential approximately 75,000 volts. No difficulties have been encountered in either generating or applying this high potential.

Referring to Mr. Lighthipe in his statement that the application of the electrical precipitation processes have been made commercially profitable at the works of the Riverside Portland Cement Company through the recovery of valuable products formerly lost, I wish to state that the major question at the cement factory was not that of recovering valuable materials but was a problem of overcoming a nuisance feature. The farmers in the adjacent country declared that damage was being done to the orange groves. Whether this is actually true has never been proven, in spite of the fact that thousands of dollars were spent in the lengthy court fight between the farmers and the Colton cement factory, in the course of law suits covering several years. The problem is therefore to be looked at as a nuisance question rather than one of damage to the surrounding territory. The material which was formerly lost from the cement factory is not cement, but consists of a partially calcined raw mix. At Riverside the raw mix consists of a mixture of limestone and rotten granite, the granite being high in potash feldspar. The material caught in the electrical treaters consists of a partially calcined raw mix, being possibly 50 per cent calcined, and in addition contains considerable quantities of potash salts, these being the result of decomposition of the feldspars in their passage through the rotary kiln, the votilization of the potash with subsequent sublimation and collection in the electrical treaters along with the dust. The material collected, although not a valuable product in comparison with finished cement, is valuable as a basis for the manufacture of cement, and also as a soil dressing for fertilizer purposes due to its lime and potash content. Quantities have also been used as a "filler" for asphalt paving. The fact that the material collected at Riverside has proven sufficiently valuable to make the installation self sustaining, has been a source of gratification to us all.

The more recent applications of the processes practically all deal with the recovery of the valuable flue dusts, where the recovery of the dust itself constitutes a large financial profit. These installations are all in the larger metallurgical plants. In one of these plants it is estimated that the material collected will have a net value of a quarter of million dollars per year.

Slides were then shown illustrating a number of applications to the metallurgical field and also illustrating the collection of carbon smoke at Pittsburg.

Dr. H. W. Morse: In connection with the theory of precipitation it might be interesting to mention that we have tried experiments in the laboratory with quite large objects. Using a brass plate about 4 ft. long as positive electrode and a small wire about 8 in. from it as discharge electrode, small steel bicycle balls are easily deflected through a considerable distance. For a fall of 8 or 10 ft., passing the 4 ft. plate about half way in its path, a steel bicycle ball is deflected by a field of 20,000 volts or so nearly 3 in. out of vertical. It seems evident from these and similar experiments that what we ordinarily understand by ionization is only one of several factors which may influence the precipitation of dust particles. No accumulation of ions within our experience would account for the force which acts on these steel balls. It seems very probable that three factors at least are effective and that these act in varying proportions, depending on the size of the particle to be moved. For very small particles, gaseous ions may accumulate in sufficient number to cause a motion of the particle in the field. As the size of particle increases, this factor becomes less important and for larger masses it may be that electrostatic induction, or some other field distortion, would account for the force. A great many experiments have shown that what has been called electric wind may be a factor of considerable importance in producing the motion of particles.

(Mr. Wesley Beach, one of the attorneys who conducted the injunction suits for the Orange Growers against the California Portland Cement plant at Colton, California, being present, was invited to comment on the paper from the standpoint of the Orange Growers.)

Wesley Beach: I am intensely interested in the subject of this paper, but I did not come prepared to take part in the discussion. For the past five years I have devoted a large part of my time to furnishing the inspiration for the conduct of the experiments which have just been described. Mr. Walter Schmidt has modestly disclaimed being the father of this invention, sharing the glory with the other gentlemen who have spent so much time and energy in working out these problems. I have not contributed any of the gray matter employed in their solution, but if necessity is the mother of invention, I think I may lay some slight claim to parentage, or relationship at least, to this invention, on the maternal side.

About the time that Mr. Schmidt commenced his experiments at the plant of the Riverside Portland Cement Company, I was engaged in the trial of the injunction suits against the California Portland Cement Company at Colton. The trial occupied about ten weeks in the superior court of San Bernardino county and hundreds of witnesses were examined, including experts in nearly every branch of science from chemistry and botany to ornithology—I believe the baleful influence of cement dust upon even the bird life of the community came in for mention.

There are some facts which might be mentioned which are most interesting, from the standpoint of the layman, and that is the standpoint from which I am accustomed to view the situation, although from having spent my boyhood amid the citrus industry, and having assisted in cultivating and caring for some of the orange orchards in the so-called "dust zone" of the cement plant at Colton, and later as teacher of chemistry in the Colton High School, where I used to take the chemistry class through the mill of the California Portland Cement Company as a demonstration of the application of industrial chemistry, I gained some insight into the technical side of the problem.

The old cement plant at Colton has been in operation for about twenty years; formerly it was a small affair, operated only intermittently, and little damage was done outside of the radius of a few hundred feet, but in 1908 the company built a new mill, with several times the capacity of the old mill, and very soon after its operation was commenced it became apparent to all the residents of that community that very serious damage was being done by cement dust. Within three months after it commenced operation every solar heater in the town of Colton was put out of business; nothing but acid would remove it from glass, and within a few days it would be as bad as before. The trees and buildings began to assume the appearance of an ash heap. The cement dust was very tenacious and could not be washed off or removed from the foliage or other objects upon which it settled. The orange tree was peculiarly susceptible to damage from the dust for the reason that the orange leaf remains upon the tree for from three to five years, and the coating of cement dust upon the leaves of the orange trees became constantly thicker with the lapse of time.

At the time the suits were commenced to enjoin the operation of the Colton plant, the company believed, and the evidence at the trial indicated, that the difficulties in the way of the control of the cement dust were insurmountable. According to the most reliable data that could be secured from various plants throughout the United States at that time, it was estimated that the Colton plant was losing from ten to twenty tons of partly burned raw mix per day in the dust discharged from its chimneys. Subsequently, when a system of dust control had been installed at the Colton plant, it was found that they actually caught and saved in their treaters sixty tons of dust per day, and that with a greatly reduced draft through the kilns, so that it is safe to say that a very much larger quantity than that amount was formerly discharged out of their stacks daily This dust settled upon the surrounding territory in quantity sufficient to cause damage for a radius of several miles. The cement company's plant represented a very large investment and the surrounding territory included some of the highest priced farming land in the world. Both sides went in to the legal battle believing that the result would be destruction for one side or the other. In fact when the supreme court rendered its decision approving the injunction, the door of hope for the solution of these problems was just beginning to open. Subsequently the Colton plant completed the installation of a system of dust control on a different principle from the one described here, and while there is still some difference of opinion betewen the company and the growers, as to the absolute efficiency of the device, the results attained are so promising that an end of litigation is in sight.

The conditions surrounding the Riverside Portland Cement Company when they commenced to operate their plant, in Riverside county in 1910, were very similar. The plant was much larger than the one at Colton; the dust zone included thousands of acres, and the lands in it were very valuable. The problem of controlling the dust was new, the difficulties enormous, and the time for solution short. The company promised to proceed with all diligence to abate the dust nuisance but the deposit of dust was so enormous, and the damage from it so great, that the farmers were threatened with quick destruction, and they were compelled to put in motion the wheels of justice in order to secure quick action if the experiments which the company had undertaken at great cost, should fail.

I understand that the tests for efficiency mentioned by Mr. Taylor were made within the plant. Sufficient time has not elapsed to measure its efficiency by the results upon the neighboring farms. The trees still carry the burden of dust from former years. The farmers hope fervently that the company will be absolutely successful and these gentlemen have earned a large measure of glory for the energy and boldness with which they have attacked this problem and for the degree of success which they have thus far attained.

We have about fifty injunction suits pending against the Riverside Portland Cement Company in Riverside county, which we shall be very glad to dismiss when it has been conclusively demonstrated that the dust nuisance has been abolished.

Electrical atmospheric charges for the benefit of crops, have been used extensively in experiments by Sir Oliver Lodge. A positive charge was applied which acted as a supplement to the positive charges caused by the sun, and the increase in the yield of the crops in this way amounted to as high as 30 per cent. No increases were, however, recorded during 1911, a year of drought in which the atmospheric charges were sufficient due to the effect of the sun alone. The charge was applied over the crop area to be treated by means of No. 11 wire supported and insulated on poles 16 ft. above the level of the ground; between these, cross lines of No. 24 wire were stretched. The pressure used was 100,000 volts. It was found possible in this manner to increase the electrically charged state of the atmosphere to 10,000 times the normal. There was reason to believe that certain plants of a leguminous kind would thrive better on the application of a negative charge.

ELEMENTS OF FUEL OIL PRACTICE AND BOILER TESTING

BY ROBERT SIBLEY.

Units.

Fable has it that Sir Isaac Newton, when a boy in England, lying one day under an apple tree and gazing upward, saw an apple fall to the ground. The contemplation of this phenomenon lead Newton to give to the world three fundamental laws upon which modern engineering is built. Briefly stated these laws are as follows:

Law 1. Every body continues in a state of rest or a state of uniform motion in a straight line except insofar as it may be compelled by force to change that state.

Law 2. Change of motion is proportional to impressed force and takes place in the direction of the straight line in which the force acts.

Law 3. To every action there is always an equal and contrary reaction; or the mutual actions of any two bodies are always equal and oppositely directed.

A force is said to be acting, then, according to Law 1, whenever the physical conditions are such that velocity is changed in magnitude or direction. Thus, when a train of cars is started or stopped, a force is necessary to cause this phenomenon, and this is evidently a change in the magnitude of the velocity. On the other hand, in the rotation of a fly wheel, the velocity may change solely in direction without a change in magnitude, and yet a force be necessary to maintain its parts in equilibrium. Hence a force may be considered as a push or a pull acting upon a definite portion of a body. Such a push or pull always tends to change the motion of the body; but this tendency may be counteracted in whole or in part by the action of other forces. In the latter instance the force is usually denoted as pressure, and it is the consideration of this latter case, or the consideration of pressures, that will largely concern our attention in the generation of steam in a boiler.

In considering Law 2, it is seen that there is some inherent property in matter that makes it difficult to set in motion. Physicists have defined this quality of matter as being the inertia of a body. Inertia is expressed quantitatively in engineering practice in terms of its mass, which is measured in pounds. In order that these quantities, force and mass, now introduced may be quantitatively measured, it is necessary to have some fundamental units upon which to base our computations. Three units only are fundamentally required; namely, a unit of length, a unit of mass, and a unit of time. Scientific practice has deduced for these units the centimeter, the gram, and the second, which are well known and need no further illustration. In engineering practice, however, especially among English-speaking people, the foot, the pound, and the second seem to be in almost universal usage. We shall consequently largely express our deductions in terms of these latter units.

Having now decided upon the three fundamental units of measurement, let us look into other fundamental definitions and secondary units to be employed.

Since engineering science must deal with motion and the change of motion per unit of time, it is necessary that we have units wherein to measure them. Change of motion per unit of time is known as velocity and is expressed in feet per second. A change in motion may, however, be undergoing a change, and this phenomenon is known as acceleration, which is measured by the change of velocity in feet per second.

Since a force **P** is fundamentally defined as being proportional to the change in motion of a body, it follows that a force is equal to a constant, **M** multiplied by the change in motion, or, in other words, multiplied by the acceleration, **a**. Hence

$$P = Ma \qquad (1)$$

According, then, to this fundamental equation, a unit of force, the pound is such a force as will give to a pound mass the same change of motion per second as is acquired by a body falling freely to the earth's surface. Since bodies acquire different changes of motion per second, or, in other words, different accelerations, at different points on the earth's surface, a standard has been adopted by means of which proper corrections may be made. Incidentally the pound mass, although itself a definite quantity, becomes difficult of measurement in extreme accuracy, for in engineering practice the mass of a body is often ascertained by measuring the force that gravity will exert upon it at a given point and thereby deducing its mass from equations. A concrete illustration of this will appear in the next chapter wherein a mercury column is used to measure atmospheric and vacuum pressures at different latitudes and altitudes.

This constant, **M**, is the measurement of the units of inertia above alluded to and is denoted in pounds of mass, since the product of pounds of mass and acceleration give us at once the force action in pounds of force. It is unfortunate that mass and force have the same unit of expression, for they are definite distinct physical concepts and should be carefully distinguished in order to avoid confusion.

Since in Law 2 we are informed that the change of motion takes place in the direction of the straight line in which the force acts, it is often convenient to note quantitatively the product of the force and the distance through which the force acts. This product is called "work" and is numerically computed by multiplying the force in pounds by the distance in feet through which the force acts. The resulting computations are then expressed in foot-pounds (ft. lb.) Thus, if the mean effective pressure, **P**, in a cylinder is measured in pounds per sq. in. and the piston has an area of **A** sq. in., it follows that the total force or pressure acting in the direction of the motion of the piston is **PA**. When this force has pushed the piston the length of its stroke, **L** ft., the work accomplished is **PLA** ft. lb., since this is the product of the force and the distance through which the force acts. If there are **N** working strokes per minute, the ft. lb. of work accomplished every minute are now seen to be **PLAN**.

The mention of the words "per minute" in the last statement now indicates to us that the time taken to perform a given quantity of work in engineering practice is of vast importance. Consequently this fact necessitates still another unit of measurement, namely that of power. Power is defined as the time rate of doing work. The horsepower is the basic unit. When 550 ft. lb. of work are performed per sec., or 33,000 ft. lb. per minute, a horsepower is said to be developed. Hence, since in the above engine cylinder PLAN ft. lb. per min. are being developed, the horsepower is computed as follows:

$$\text{h. p.} = \frac{\text{PLAN}}{33000} \qquad (2)$$

Thus in Alameda, California, a certain Deisel oil engine has a piston area of 37.7 sq. in., a stroke of 1.5 ft., a mean effective pressure of 23.36 lb. per sq. in., and each cylinder makes 125 working strokes per minute. Hence each cylinder develops.

$$\text{h. p.} = \frac{23.36 \times 1.5 \times 37.7 \times 125}{33000} = 50.0$$

Under the heading of "Rating of Boilers" in a succeeding chapter the particular power units employed in steam engineering practice will be considered in minute detail, such, for instance, as the horsepower, the boiler horsepower, the force de cheval, and myriawatt.

Another important consideration is that of the physical characteristic of a body which enables it to perform work. This physical quality possessed by a body which enables it to perform a definite quantity of work is spoken of as its energy. Energy then is the capacity for work. In general we meet with two great classes of energy. One is that of kinetic energy, or energy of motion. According to Law 2, if the motion of a body be changed, a force is required. Hence a body actually in motion possesses kinetic energy. The other type of energy is known as potential, or energy of position. Thus steam moving with a high velocity, by the nature of its kinetic energy, is enabled to drive the wheels of an impulse turbine. On the other hand, crude petroleum when heated so that it will unite with the oxygen of the air gives out energy in the form of heat, which may be caused to do useful work. The energy inherently latent in the crude petroleum is known then as potential energy. Engineering practice is largely concerned with the harnessing of various forms of energy. Looking about us in nature and in modern engineering accomplishment, we may see numerous instances of energy. The steam engine and steam turbine indicate a form of mechanical energy; the incandescent light, or the dynamo, that of electrical energy; the evolving of heat in the burning of crude oil, that of chemical energy; the human conducting of affairs, that of human energy; the rays of light from the sun, dissipating eternally 10,000 h.p. over each acre of the earth's surface, that of solar energy, and so on indefinitely.

Modern investigation has conclusively established the fact that all types of energy are interchangeable, and though some types of energy are more readily convertible into other types, yet the basic law is true that no energy in sum total is ever destroyed, and on this basis, or law, known as conservation of energy, practically all of our engineering formulas and computations are based.

In the following chapters the conversion of the chemical energy of crude oil into heat energy of the furnace and thence into steam will largely concern our attention. Thus each pound of California crude oil will be found to contain approximately 18,500 B.t.u. of heat energy. This energy of one pound of oil when wholly converted into mechanical energy is sufficient to lift a person weighing 150 lb. through a vertical skyward journey of some 18 miles. Hence the study of the application of such enormous reservoirs of energy, latent in crude petroleum, will prove intensely interesting and instructive.

LETTERS TO THE EDITOR.

Increasing Membership in the Illuminating Engineering Society.

Philadelphia, Pa., February 21, 1914.

Dear Sir:—Because it has a definite message to proclaim, namely, that of better lighting, the Illuminating Engineering Society wishes to enlarge its sphere of influence. It is proposed to increase the membership by two or three hundred members between now and the 1st of July.

It is important however that the members secured should be selected from among those who are really interested in improvements in lighting, so that they do not become mere recipients of the transactions, but seize occasions as they present themselves for expounding the principles of good lighting as they find them set forth by the Society.

Membership at present is not properly balanced geographically being centered too much in the larger cities.

I think it should be our aim to have scattered widely throughout the country, men who through their connection with this Society are able to recognize bad lighting and who will suggest good lighting methods iustead. Bad lighting generally exists through ignorance and not through intention.

The human eye is the same in all localities, and it is just as important that the proper illumination of objects it is to see be everywhere accomplished, in the smaller cities and in rural districts as it is in some of the larger cities.

The members desired are those who as wide-awake citizens and alert in the interests of good lighting will see to it, that where an installation is contemplated which bids fair to be atrocious, that proper criticism in the nature of a warning can be given by them, before the money is spent.

We of the illuminating engineering society feel proud of our mission; we feel that no society can hope for an extensive growth unless its membership is enthusiastic and active. The best assurance of enthusiasm is that we are engaged in a helpful and progressive undertaking in which no man need hesitate to join.

"A member may be anyone interested in the objects of the Society."

I wish we could include among our Sections one or more in California before the close of the present year.

We had a council meeting in New York last Thursday and it was very gratifying to those present to note what is being done on the Pacific Coast.

I am also pleased to note the articles you are running on Lighting Methods. Your journal is to be congratulated upon the stand which it is taking on this matter of better lighting. Very sincerely yours,

(Signed) CHAS. O. BOND,
President, Illuminating Engineering Society.

(The Journal will be pleased to supply additional information regarding the Illuminating Engineering Society to all those interested.—The Editors.)

ELECTRIC SMELTING OF ORES AND METALS

With the view of developing more efficient methods in the smelting of ores, the Bureau of Mines began a detailed investigation of the practicability of using the electric furnace as a substitute for or adjunct of the blast furnace, with particular reference to the treatment of low grade ores.

One problem studied is the possibility of using crude oil as a reducing agent. The results of these experiments, which were made by J. F. Cullen under the direction of D. A. Lyon, were incorporated in a report for publication. Another problem, still under investigation, is the possibility of using the electric furnace in the smelting of copper ores, especially sulphides. The experiments incidental to this investigation included work on:

1. The smelting of copper concentrates. Experiments have been made to determine to what degree loss of copper in the slag could be lessened by smelting these concentrates in an electric furnace.

2. The use of the electric furnace in the smelting of nonferreous ores. The purpose of this investigation is to determine the feasibility of using electricity as a source of heat in smelting copper-iron sulphide ores, lean zinc and lead ores, and in fact all low grade ores that are not amenable to treatment by wet methods, and especially to ascertain whether the electric furnace may be used profitably for treating ores from deposits that are so far from a smelter that transportation charges exceed the value of the metals in the ores. In some cases it may be possible to use hydroelectric power in an electric furnace, thus removing the necessity of tarnsporting worthless gangue, and enabling the metals of the ores to be transported as matte or crude metal, providing it was not feasible to refine the metal at the smelting plant.

3. The use of the electric furnace as an aid to the ordinary blast furnace. In the study of this problem the following points have been considered:

(a) The possibility of recovering the iron in the slag as metallic iron. At present, as is well known, although the iron content of a gold, silver, copper, or lead ore may be large, it goes to the dump in the slag, either as iron oxide or iron silicate.

(b) The possibility of producing ferro-silicon from the slags ordinarily obtained in smelting nonferreous ores.

(c) The recovery of the sulphur as a by-product in the smelting of sulphide ores.

(d) The discovery, if possible, of some suitable collector or carrier other than copper and lead for the precious metals in smelting practice.

The purpose of the work has not been to show that the electric furnace should replace reverberatory or the blast furnaces, but that in some places it may be substituted for them. So far only the possibility of treating copper sulphide ores has been studied. The results of the work will be published in a bulletin. The electric furnace work for these investigations has been done by R. M. Keeney, under the direction of D. A. Lyon.

New investigations proposed for the coming year include: The electric smelting of zinc ores; the smelting of titaniferous iron ores; the production of "natural alloys"—that is, the production from complex ores of alloys containing different metals in such proportions as to be of commercial use for structural materials, for tool making, etc.; the use of an electric process for removing moisture from the blast supplied to blast furnaces; the removal of sulphur from producer gas for metallurgical purposes.

The following reports have been or are being prepared for publication:

"The Use of the Electric Furnace in the Manufacture of Iron and Steel," by D. A. Lyon and R. H. Keeney; "The Use of Crude Oil as a Reducing Agent in the Reduction of Iron Ores," by D. A. Lyon and J. F. Cullen; "Smelting of Fine Michigan Copper Concentrates in the Electric Furnace," by R. M. Keeney; "The Use of the Electric Furnace in Metallurgy," by D. A. Lyon, R. M. Keeney and J. F. Cullen; "The Possibility of Smelting Copper Ores in the Electric Furnace," by D. A. Lyon and R. M. Keeney.

These investigations have been carried on by D. A. Lyon, metallurgist, and J. F. Cullen, Electrometallurgist; W. A. Mueller, chemist (from October, 1912, to January, 1913); R. M. Keeney, Electrometallurgist (from February 1, 1913).

LIGHTING WITH THE MERCURY-VAPOR QUARTZ LAMP.

On account of its extremely high efficiency, the quartz lamp has rapidly found a wide application in the lighting field, though its color up to the present time has limited it to industrial work.

On account of the elimination of trimming, lamps can be placed high up and in inaccessible places without the necessity for special runways and platforms. A reasonably wide variation of line voltage is permissible and the lamps can be operated from power circuits without any trouble being experienced.

A few typical installations are tabulated below. These show some of the different classes of work for which quartz lamps are used and the watts per square foot required for satisfactory results.

Quartz Lamp Installation Data.

	Lamps.	Sq. ft. per Lamp.	Watts per sq. ft.	Mounting Height (feet).
Boiler shop	4	4,500	0.16	48
Plate glass manufacture	4	2,330	0.35	35
Mechanical engineering laboratory	7	1,120	0.69	35
Locomotive repair shops	12	2,992	0.25	52
Heavy machine shops	3	3,270	0.23	45
Foundry	2	2,400	0.29	42
Paper mill machine room	2	2,000	0.35	30
Steel construction	72	4,166	0.17	40
Heavy machine shop	2	2,500	0.28	19
Drill hall	8	3,900	0.20	30-40
Foundry and erecting shop	96	3,600	0.21	35-50
Steel punching shop	9	6,880	0.11	35-40
Engine room	3	2,541	0.39	44
Turbine room	7	2,857	0.25	46
Moulding	3	5,700	0.16	35
Engine room	2	3,600	0.22	40

Besides the above, quartz lamps have also been used for smelting and steel works, locomotive works, and, in fact, for all industrial operations where the height necessary for good distribution could be obtained.

The above data is abstracted from a paper by W. A. D. Evans in the January, 1914, transactions, Illuminating Engineering Society.

ELECTRICAL IRRIGATION

IRRIGATION PUMPING WITH ELECTRIC POWER.

BY H. F. McPHAILL.

(The importance and economy of electric pumping for irrigation are referred to, a typical rate for this class of service stated, and several operating costs and data given. This paper was read at the recent Safety Conference, held at Reno, Nevada.—The Editors.)

With the agricultural opportunities offered by Nevada becoming more and more recognized the amount of land capable of being irrigated by gravity systems has been for the most part taken up. With the fertility of the soil undoubted and the climatic conditions most favorable to the growth of crops other means of conveying water to the ground have been brought to public notice. Those being most strongly advocated are artesian wells and power pumping.

Artesian wells having a natural flow above the surface of the ground are very rare so one naturally turns to pumping. In many localities where electrical power is not available, steam and gasoline engines are in use, but it is with electrical power that this article is to deal. Immense areas of Nevada land where lakes, streams or springs are not available for water have a porous gravel sub-formation in which large steady flowing wells may be sunk and pumping plants installed.

Electric pumping plants with a normal degree of efficiency may be relied upon to give an advantage of from 15 to 20 per cent over steam or gasoline plants, where electric power can be secured at reasonable rates. The Truckee River General Electric Company gives the following rates for pumping plants between April 1st and October 1st of each year, the pump being stopped each day during the company's peak load:

First 5000 kw.-hr	1.7 cents per kw.-hr.
Next 5000 kw.-hr	1.5 cents per kw.-hr.
Next 20,000 kw.-hr.	1.3 cents per kw.-hr.
All over 30,000 kw.-hr.	1.2 cents per kw.-hr.

In case commercial power is not obtainable it would be advantageous for several farmers to combine and install a large common plant at some central point. Power is obtained in this way much cheaper than by several separate small plants.

S. R. Young, owner of the electric plant at Lovelock, successfully irrigates about 500 acres by power pumping and is an enthusiastic advocate of its use.

W. G. Douglas by pumping water from Washoe Lake irrigates about 1000 acres and Ira Winters from the same place irrigates 260 acres. The latter lifts the water 28 ft. with a 10 in. pump of 50 h.p. capacity. He obtains power at the rate of 1½ cents per kw.-hr. and finds the cost of pumping to be 60 cents per acre ft. of water.

At the Martin ranch in Yerington about 300 acres are supplied with water by a 6 in. pump of 10 h.p. capacity. The water is pumped from the Walker river through a lift of 10 ft. and flows from there about a quarter of a mile through a ditch to the point of use. The cost of operation averages about 50 cents per acre foot. These people have other water rights but find it cheaper to pay for power and the cost of operation than to pay the ditch assessment for the other water. For this other water they pay in proportion to the amount turned in at the head of a four mile ditch and of this water about 10 per cent per mile is lost while flowing through the ditch. Plans are now on foot to install a duplicate plant at this place.

Charles Fulstone with a 10 in. pump of 50 h.p. capacity lifts water 38 ft. from a sump in a slough near the Carson River. He irrigates his land for $2.25 per acre with three acre feet of water or at a cost of 75 cents per acre foot. He also intends to put in a duplicate plant.

In other states outside of Nevada thousands and thousands of acres that were formerly worthless land have been made very valuable by means of pumping and more work is being done in this line every year. Irrigation pumping has long since passed out of its experimental stage and will in the future be the means of turning vast areas of Nevada deserts into profitable farms.

Telephone Statistics of the United States prepared for the forthcoming quinquennial report have been given out by Director W. J. Harris of the Bureau of the Census, Department of Commerce. They were prepared under the supervision of W. M. Steuart, chief statistician for manufactures.

The statistics relate to the years ending December 31, 1902, 1907, and 1912. They include the total wire mileage and the total number of telephones reported for all systems in the United States that were in operation all or any part of those years. They do not include private telephone lines used exclusively for communication between different departments of the same establishment unless connected with lines elsewhere through a private or branch exchange. The number of telephones includes all installed, including those furnishing service through private branch exchanges, local pay, and outlying toll stations.

The figures in detail are shown in the following table:

Year.	Miles of Wire.	Number of telephones.	Estimated number of messages or talks.[1]
Bell Telephone System. 1912	15,133,186	5,087,027	9,133,226,836
1907	8,947,266	3,132,063	6,401,044,799
1902	3,387,924	1,317,178	3,074,530,060
All other companies and systems 1912	5,115,140	3,642,565	4,602,431,409
1907	4,052,098	2,986,515	3,999,389,159
1902	1,512,527	1,053,866	1,996,024,493
United States.. 1912	20,248,326	8,729,592	[2]13,735,658,245
1907	12,999,364	6,118,578	[2]10,400,433,958
1902	4,900,451	2,371,044	5,070,554,553

[1] The number of messages reported by the Bell Telephone System includes only completed calls, while the figures for all other companies may include some original calls not necessarily completed; such as calls that the operator reports as "Line busy" or "Does not answer."

[2] Exclusive of companies with an annual income of less than $5000.

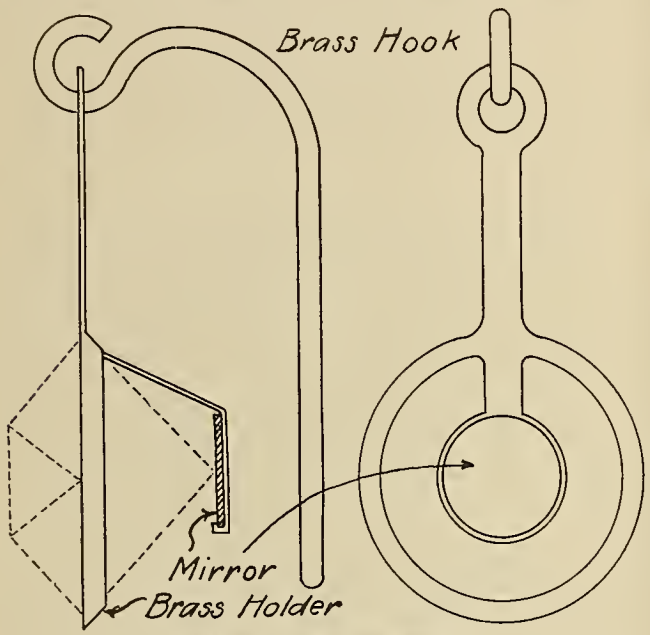
Electrical properties in Japan were, ten years ago, estimated at $14,000,000. During the elapsed period the power produced in Japan advanced from less than 45,000 to over 345,000 kw. It is now roughly estimated that the electrical plants of all kinds represent an investment of about $250,000,000.

LIGHTING METHODS

LIGHTING INSTALLATION PROGRESS, P.P.I.E.

Considerable interest has been centered in the artificial jewels to be used for decorative lighting effects on buildings, and on the Tower of Jewels in the Central Court.

Working drawings are now being made of the device, to be used for suspending these jewels from the various buildings. A metal ring one-eighth inch wide will encompass the jewel on the outer edge at an angle and a second holder at the back will bring a small mirror against the apex of the jewel. It is estimated that by the use of this mirror, the brilliancy of the jewels will be increased more than forty per cent.



Details of Jewel Suspension.

The jewel is hung by small handle with a one-quarter inch hole on a one-eighth inch hook which permits free movement in any direction and which practically amounts to point suspension.

As has been explained before the jewels are molded from an exceptionally hard flint glass in Austria and are afterward farmed out to the peasantry to be hand-cut and polished. The cut is an imitation of a well known diamond cutting.

Complete orders have been placed for all auxliliary equipment required for the operating of the three main d.c. generating stations for the control of d.c. power for exhibitors and decorative lighting.

Experiments are now being made to determine the extent to which it will be advisable to use electrical substitute for fire-work displays. Imitations of waterfalls will be used which will show gold and silver showers in the day time and at night these will be displayed to added advantage under the beams projected from searchlights.

The department is developing a new form of receptacle for use in gala and festival lighting. These are in the form of Mission bells and more than 25,000 will be used in decorative lighting. Special lamps will also be grouped so as to imitate the various forms of fruits and flowers. The lamps to be used in this feature work will be similar to those in common use for Christmas tree lighting.

NEW HIGH EFFICIENCY MAZDA LAMPS.

The new nitrogen filled lamps, which originated in the laboratories of the General Electric Company at Schenectady and which are now being manufactured by the National Lamp Works of General Electric Company under the direction of Mr. J. E. Randall, are to be known as "Mazda" lamps. This is in accordance with a statement published some time ago to the effect that a Mazda lamp would always represent the highest standard of manufacture possible.

The 750 and 1000 watt sizes are now available for 100 to 130 volt multiple service, the efficiency of the smaller lamp being 0.65 watts per candle power and of the larger, 0.60 watts candle power.

These lamps will be furnished in either the regular straight side bulb or round bulb, or in the new style round bulb with long neck.

Dimensions of the bulbs have been standardized and the filament has the same centered position in all styles and in both sizes. Bulbs may vary in size within certain limits, the maximum dimensions being as follows: Length over all (including base) 13½ in.; diameter of bulb, 7 in.; from contact point of base to center of filament, 9½ in., and the over all length less tip of bulb, 13 in.

The filament is concentrated and the spherical reduction factor is therefore high.

Many of the old fields and several new will be opened up for the use of this lamp, which, as with the case of other increased efficiencies, it will be found in the interests of all, to develop.

Precautions.

As the intrinsic brilliancy of the new lamps is so great as to be injurious to the eyes if one looks directly at the lighted lamp for any length of time, enclosing globes of diffusing glass, or indirect fixtures, should always be used unless the lamps are hung so high that they are safely out of the ordinary range of vision. A second precaution that may be observed is to protect the lamps from rain or snow, since water coming in contact with the bulb when the lamp is lighted has been known to crack it. Moreover, no enclosing globes should be used that are not so designed as to ventilate the lamp properly. It will readily be recognized that the continuous conversion of more than one horsepower of electrical energy into heat within the limited space of a lamp bulb would work mischief unless the latter were properly cooled by the outside air.

Other precautions to be taken in installing these lamps were published in a recent issue of this journal.

MONTANA ELECTRIC RAILWAY STATISTICS.

Preliminary figures of the forthcoming quinquennial report on the electric railways of the state of Montana have been given out by Director W. J. Harris of the Bureau of the Census, Department of Commerce. They were prepared under the supervision of W. M. Steuart, chief statistician for manufactures.

The statistics relate to the years ending December 31 for 1912 and 1907, and June 30 for 1902. The totals include electric light plants operated in connection with electric railways and not separable therefrom, but do not include reports of mixed steam and electric railroads nor railways under construction which had not begun operations during the census year.

The figures as presented for Montana show general gains for the decade 1902-1912. There were six operating companies in 1912 as compared with five in 1902. The miles of track numbered 99 in 1912 as compared with 63 in 1902, or an increase of 57 per cent. The persons employed numbered 390 in 1912, as compared with 192 in 1902, or an increase of 103 per cent The revenue passengers carried numbered 15,351,219 in 1912 as compared with 6,858,502 in 1902, or an increase of 124 per cent. The gross income in 1912 amounted to $1,065,597 as compared with $492,023 in 1902, or an increase of 117 per cent. The operating expenses were $770,586 in 1912 as compared with $365,073 in 1902, or an increase of 111 per cent.

The figures are given in detail in the accompanying table:

Montana.

	1912.	1907	1902.	Per cent of increase:[1] 1902-1912.
Number of companies (all operating)	6	5	5	20.0
Miles of line	82.37	57.85	55.19	49.2
Miles of single track	99.22	69.24	63.21	57.0
Cars, number	160	126	109	46.8
Passenger	139	108	90	54.4
All other	21	18	19	10.5
Persons employed	390	251	192	103.1
Salaried employes	39	20	14	178.6
Wage earners (average number)	[2]351	231	178	97.2
Power:				
Horsepower, total	1,520	1,150	1,600	—5.0
Steam and gas engines (including turbines)—				
Number	1	2	4	—75.0
Horsepower	750	1,150	1,350	—44.4
Water wheels—				
Number	3	.....	1	200.0
Horsepower	770	.....	250	208.0
Kilowatt capacity of dynamos	1,070	800	1,143	—6.4
Output of stations, kw.-hr.	1,800,000	([3])	2,128,202	—15.4
Current purchased, kw.-hr.	8,426,574	([3])	([3])	.....
Passengers carried	17,430,364	14,089,649	6,917,002	152.0
Revenue	15,351,219	13,862,231	6,858,502	123.8
Transfer	1,605,849	145,231	58,500	.....
Free	473,296	82,187	.....	.....
Car mileage (passenger, express, freight, etc.)	2,901,249	2,422,477	7,354,822	114.1
Condensed income acct.:				
Gross income[4]	$1,065,597	$902,621	$492,023	116.6
Operating expenses	$770,586	$551,933	$365,073	111.1
Gross income, less operating expenses	$295,011	$350,688	$126,950	132.4
Deductions from income (taxes and fixed charges)	$224,729	$120,851	$74,633	201.1
Net income	$70,282	$229,837	$52,317	34.3

[1] A minus sign (—) denotes decrease.

[2] Number employed Sept. 16, 1912.

[3] Figures not available.

[4] Income from sale of current for light and power included: In 1912, $242,305; in 1907, $77,993; and in 1902, $43,284.

MONTANA CENTRAL STATION STATISTICS.

These statistics relate to the years ending December 31 for 1912 and 1907, and June 30 for 1902, and cover both commercial and municipal electric plants. They do not include electric plants operated by mining companies, factories, hotels, etc., which consume the current generated, those operated by the Federal government and state institutions, or plants that were idle or in course of construction.

The figures as presented for Montana show substantial gains for the decade 1902-1912. The commercial establishments numbered 27 in 1912 and 26 in 1902. The total income amounted to $3,883,410 in 1912 as compared with $1,025,971 in 1902, or an increase of 279 per cent. The total expenses amounted to $2,411,668 in 1912 as compared with $660,476 in 1902, or an increase of 265 per cent. The total number of persons employed was 514 in 1912 as compared with 202 in 1902, or an increase of 155 per cent. The total horsepower of the engines (including auxiliary engines) was 12,825 in 1912 as compared with 7887 in 1902, or an increase of 63 per cent. The horsepower of the water wheels increased from 24,000 in 1902 to 102,885 in 1912, or 329 per cent. The output of stations in 1912 amounted to 379,212,617 kilowatt hours as compared with 36,435,766 in 1902, or an increase of 941 per cent. The estimated number of arc lamps wired for service in 1912 was 2193 as compared with 1648 in 1902, or an increase of 33 per cent. All other varieties of lamps wired for service, however, numbered 388,718 in 1912 as compared with 101,868 in 1902, or an increase of 282 per cent. The horsepower capacity of stationary motors served with electric current was 75,184 in 1912 as compared with 1401 in 1902, or an increase of 5267 per cent.

The figures are shown in detail in the accompanying table:

Montana.

	1912.	1907.	1902.	Per cent of increase: 1902-1912.
Number of establishments	29	33	27	7.4
Commercial	27	31	26	3.8
Municipal	2	2	1	100.0
Income[1]	$3,883,410	$2,469,131	$1,025,971	278.5
Light, heat and power	$3.292,385	$2,376,472	$1,017,805	223.5
All other sources	$591,025	$92,659	$8,166	7,137.6
Total expenses, including salaries and wages	$2,411,668	$1,469,808	$660,476	265.1
Total number of persons employed	514	319	202	154.5
Total horsepower	115,710	68,817	31,887	262.9
Steam and gas engines (including turbines):				
Number	39	31	26	50.0
Horsepower	12,825	11,830	7,787	64.7
Water wheels:				
Number	64	62	44	45.5
Horsepower	102,885	56,987	24,000	328.7
Auxiliary engines:				
Number	([2])	.....	5	.....
Horsepower	([2])	.....	100	.....
Kw. capacity of dynamos	74,398	39,602	22,055	237.3
Output of stations, kw.-hr.	379,212,617	137,379,261	36,435,766	940.8
Estimated number of lamps wired for service:				
Arc	2,193	[3]3,123	1,648	33.1
All other varieties	388,718	[3]231,201	101,868	281.6
Stationary motors served:				
Number	1,962	971	151	1,199.3
H.P. capacity	75,184	33,240	1,401	5,266.5

[1] Exclusive of $242,305 in 1912, $77,993 in 1907, and $43,284 in 1902 reported by street and electric railway companies as income from sale of electric current for light or power or from sale of current to other public service corporations.

[2] Not reported separately.

[3] Exclusive of 68 arc and 2507 lamps of other varieties reported by the electric companies as used to light their own properties. Lamps used for such service were included in the number reported for 1912.

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FOUNOED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

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A Critic Criticized

Not a week passes but there is brought to our attention, articles reprinted in other periodicals from this journal, in whole generally and sometimes in part, without due credit being given to us as the original publishers of the copyrighted articles so used.

This is bad enough, and some of the purloining periodicals have, under pressure, promised future action in accordance with the ethics of the publishing business, but this appropriating has now taken on a more subtle form.

An esteemed contemporary condenses the essentials of one of our recent editorial writings into a rather lengthy paragraph, and then goes on to say that the ideas suggested are a result of an attempt to focus attention upon the subject by supply dealers, jobbers and a few lamp manufacturers.

Seeing that there are only "a few lamp manufacturers," we are pleased to note that our contemporary considers that the ideas which we suggested and which originated in our editorial rooms, represent the combined opinions of several important branches of the electrical industry.

We would point out to our contemporary that it was not advocated that central stations should "cease to exercise supervision over the lamps connected to their circuits." But in view of the fact that "the Public Service Commission law gives the commission explicit supervision over the efficiency of the electric incandescent lamps supplied," if this indeed be so, then there is no reason why central stations should sell lamps, at cost or otherwise, in order to ensure "that the public receive the very best lamps of highest efficiency at minimum expense." The remedy, apparently, lies elsewhere.

This may be dismissed with the statement that the privilege of those who cannot meet arguments is to resort to ridicule.

But it will take more than ridicule to alter the fact that discrimination does exist whenever a central station sells any commodity at cost or at less than a fair profit, and that to the extent that this is done the business of legitimate electric supply houses is injured.

The argument is advanced, notwithstanding the admitted protection afforded consumers from other sources, that "central stations have experienced the necessity of testing the lamps being supplied to customers and would not leave the consumers without this safeguard." In refuting such a stand it need only be said that not one thousandth of one per cent of the lamps sold by central stations are tested by them for quality; that the only "test" which they do receive is one to show that the lamp will light. Every dealer does this for his own protection.

That a central station may sell electric lamps and appliances as "part of the service they render," is a

condition which no one particularly desires to eliminate.

The points to be made are, that control of lamp sales by the central station is not essential in the interests of their customers; that sales of lamps and appliances at cost or at less than a fair profit shows discrimination and should be eliminated; that the competition from such central station sales should not be unfair; and incidentally, that if others must use the ideas or articles published in this journal, we would prefer that they give us credit for them, even though they think that we are wrong.

Imperative Improvements

The article in this issue on the electrical precipitation of cement dust emphasizes the fact that necessity must often kick men from behind before they will make that progress which is best for their own interests, and for those of their neighbors. Necessity is still the mother of invention.

It is also of value as a description of the successful utilization of some of the more recent scientific discoveries the practical application of which have heretofore been impossible due to the lack of the necessary auxiliary apparatus.

That in the early stages the saving in product is found to be sufficient to offset the cost of removing this nuisance of dust falling upon the surrounding country, augurs well for the future more profitable use of such systems.

Foreign matter escaping into the air whether in the form of fine cement dust, or smoke, may be injurious to health, to plant life or to the appearance of the country side, as well as damaging to property. It is generally offensive and a cause of discomfort.

Scientists have been, and are, attacking from many angles the problem of keeping the air comparatively free from such impurities.

Hydroelectric development of the West has been hampered and electrical energy is not therefore available for general fuel purposes. In many places less favored than the West, it is probable that such a desirable circumstance of heat without vitiation or pollution of the air will not be realized from the utilization of this "white coal."

For them the problem is being attacked differently and experimental plants are already in operation which distil coal at low temperatures and thus produce a smokeless fuel for domestic purposes; the yield also containing many other valuable products, such as fertilizer, fuel oil, and so forth.

Fuel oil, used carelessly, constitutes perhaps one of the greatest nuisances, for the dense smoke, which is also obnoxious, contains an oily soot as well.

In this connection it is worthy of note that the nuisances sometimes represent enormous losses to those responsible for them. The removal of the nuisance would result profitably to them. In some large cities the cost of the smoke nuisance alone, expressed as a per capita loss, is as high as nine dollars.

The system described in this issue has been applied to the collection of carbon smoke and a number of installations have also been made in smelters where the economic possibilities are enormous.

As a record of accomplishment, the article is of more than passing interest, and points clearly to even greater possibilities, and to opportunities over which the inventive could profitably ponder.

Lighting Legislation

Practically every general article on the subject of illumination mentions the continually increasing brilliancy of lamp filaments necessitating the equipment of modern lamps with diffusing glassware or with some opaque reflector which, inverted, directs the light to the ceiling or over some other relatively large surface, thus reducing the brilliancy of those light giving areas, primary or secondary, which come within the range of vision.

Much of the lighting equipment in use today, is an outgrowth of those years when either candle sticks or oil lamps were the portable forms of lighting apparatus used and the chandeliers were necessarily installed within reach that the candles might be conveniently lighted or snuffed, if required.

The fundamental considerations upon which good lighting depends, do not always enter into the planning or installation of modern electroliers and electric portables.

Then there are those purchasers who can never be told anything to their good. They who see in the earnest appeal of the expert lighting salesman, an attempt merely to increase the first cost. The resulting installation, made with cheapness as a criterion and based upon ignorance, rarely embodies any of the essential requirements, and a lighting installation which is a menace to eyesight, results.

This was true of the carbon filament lamp and more so of the later high efficiency metal filament lamps, the careless use of which but barely escaped being a crime.

Now the advent of the new nitrogen filled metal filament lamp of even greater brilliancy, calls for scientific installation—the use of adequate equipment.

But you cannot teach your "cheap" purchaser and as a result, lighting legislation must follow.

Whatever laws are made regarding the use of lamps of great brilliancy should, however, be based upon the most expert knowledge that they be clearly and scientifically stated, so that there shall be no question, as was the case with the headlight laws of various states, as to their correct interpretation.

To this end, sections of the Illuminating Engineering Society, with a membership composed of those interested in the science and art of illumination become centers of sane influence which might accomplish much toward the passage of the most effective local laws. This should serve to further stimulate active interest in this society.

In this issue is a letter from Mr. C. O. Bond, president of the Illuminating Engineering Society to which the attention of readers is particularly directed.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

Thos. Mirk, president, Hunt, Mirk & Company, San Francisco, is a visitor at Los Angeles.

N. E. Cheney has been appointed Alternate Jovian Statesman at Seattle, Washington.

Fred B. Fressen, representing the Luminous Unit Company of St. Louis, is at Salt Lake City.

Geo. A. Campbell, general manager, Truckee River General Electric Company, is at San Francisco from Reno.

L. Arbogast of the Newbery Bendheim Electric Company, Los Angeles, was at San Francisco during the past week.

F. W. Mielenz, manager, Napa Valley Electric Company, St. Helena, Cal., was one of the visitors at San Francisco this week.

W. W. Hanscom, consulting engineer, San Francisco, was recently elected a member of the Illuminating Engineering Society.

Harry Adams, Phillips Insulated Wire Company, Pawtucket, R. I., is calling on the Pacific Coast trade and is now at San Francisco.

Louis R. Krumm, radio expert, connected with the wireless telegraph bureau of the United States Treasury Department, is at San Francisco.

Samuel Insull, president of the Commonwealth Edison Company, Chicago, Ill., is visiting Pacific Coast cities and is at present at Pasadena, Cal.

Arthur Walser, district manager motor department, General Electric Company, Denver, Colorado, is making a trip through the Salt Lake district.

Ernest F. Schettler, chief clerk of the Intermountain Electric Company of Salt Lake City, is back at his desk after being confined at his home by sickness.

W. W. Torrence, local manager of General Electric Company at Salt Lake City, left last week for Schenectady on his regular general visit to the home office.

C. L. Hull, foreman standardizing laboratory, General Electric Company, San Francisco, has left for a six weeks' trip to the company's works at Schenectady.

R. C. Heaton, until recently with the Washington Electric & Manufacturing Company, is now connected with the Home Electric Company of Tacoma, Wash.

W. M. Deming, general sales manager General Electric Company, Schenectady, attended the Del Monte electrical jobbers' convention and is now at San Francisco.

R. H. Sperling, general manager, British Columbia Electric Railway Company, Vancouver, B. C., is at present visiting Southern California accompanied by Mrs. Sperling.

L. A. Osborn, vice-president Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., attended the Pacific Coast Electrical Jobbers' convention at Del Monte.

Curtis B. Hawley, president and general manager of the Intermountain Electric Company, has returned from an extended eastern trip during which he attended the Jobbers' Convention.

A. D. Page, sales manager, Edison Lamp Works of General Electric Company, Harrison, N. J., was a visitor at the recent convention of the Pacific Coast Electrical Jobbers held at Del Monte.

Fred F. Skeel, sales manager, Crouse, Hinds Company, Chicago, Ill., was one of the eastern visitors at the Del Monte convention of the Pacific Coast Electrical Jobbers and is now at Los Angeles.

J. F. NePage and **V. S. McKenny** of the firm of Ne Page, McKenny & Company, Seattle, were at San Francisco last week in connection with the city hall contract. They also visited Los Angeles.

D. F. McGee, chief engineer of the Pacific Power & Light Company, Portland, Oregon, has been promoted to the position of assistant to the president of the Electric Bond & Share Company, New York, N. Y.

E. A. Wilcox, Twelfth Mars, was responsible for a most successful rejuvenation of the Jovian Order held at Twin Falls on Saturday, February 28th, under his direction. Sixteen initiates were taken into the order.

Walter Cary, vice-president and general manager, Westinghouse Lamp Company, Pittsburg, Pa., was at San Francisco during the past week after having attended the Del Monte convention of the Pacific Coast Electrical Jobbers.

O. F. Swenson has been appointed manager of the new offices opened by Hunt, Mirk & Company, Engineers and Contractors, San Francisco, in the Alaska Building, Seattle, Wash., and will have charge of the company's business in the Pacific Northwest.

G. N. Barker has been elected chairman of the Portland Section, National Electric Light Association; **Chas. P. Osborne**, vice chairman; **R. L. Carroll**, treasurer; **C. C. Craig**, **L. A. McArthur**, and **O. B. Coldwell**, members of executive committee, and **B. Goodwin**, secretary.

B. H. Scranton, president American Electric Heater Company, Detroit, Mich., and **Frank Kuhn**, vice-president of the company, now en route to Portland and Seattle, were visitors at the convention of Pacific Coast Electrical Jobbers, held at Del Monte during the latter part of last week.

C. S. Walton, **A. Petsch**, **Fawcett Robinson**, **W. G. Hutchinson**, **E. R. Northmore**, **J. B. Wheeler**, **L. O. Lieber**, and **R. H. Manahan** have been appointed members of the Los Angeles committee on electrical display for 1915. This committee is to interest merchants and property holders in appropriate decorative lighting effects for exposition year.

Van Rensselaer Lansingh, who has been appointed manager of a recently organized department in the National Lamp Works of General Electric Company, with offices at the National Lamp Works, Nela Park, Cleveland, will have general supervision over the manufacture and sale of reflectors both glass and metal.



Mr. Lansingh has been prominent in the activities of the Illuminating Engineering Society, in fact was one of its founders. He was general secretary in 1906 and president for the term ending in December, 1912. Since then Mr. Lansingh has also served as treasurer, vice-president and president and is perhaps in the minds of central station men more closely identified with the advancement of scientific principles in regard to the use of reflectors of light sources than any other man in this country. Mr. Lansingh in July, 1900, formed the V. R. Lansingh Company in Chicago, sales agents for Holophane globes and reflectors. In September, 1904, he was appointed general manager and chief engineer of the Holophane Works of General Electric Company, Cleveland, the headquarters of which have recently been located in that city. Mr. Lansingh has very frequently contributed to the proceedings of the Illuminating Engineering Society and to the technical press of this and other countries. The progress made by the Illuminating Engineering Society during the past year has been considerable, much of which is due to Mr. Lansingh, who can always be depended upon in committee work not only to do his share, but to see that those under him have a strong working interest in the results sought.

MEETING NOTICES.

Portland Sections A. I. E. E. and N. E. L. A.

Mr. Paul Lebenbaum's paper on the "Electrification of the Portland, Eugene & Eastern Railroad," was thoroughly enjoyed by everyone present and called forth more discussion than any paper so far presented. The attendance was 125.

Seattle Jovian League.

The Jovians of Seattle held their weekly luncheon at the Lincoln Hotel Friday, March 6th, at 12:30 p. m. The after-dinner speaker was Mr. Carl Bush of the A. G. Company who spoke on the improvements that have recently been made by the company he represents in iron boxes and protective devices.

Portland Electrical League Luncheon.

At the regular Wednesday luncheon held in the Blue Room of the Multnomah Hotel, Portland, Ore., motion pictures were shown of the construction of the Northwestern Electric Company's steam and electric underground generating and distributing system. Also a film showing the methods used to transport the 50 ton steam turbine from the freight yards to the power station.

San Francisco Electrical Development and Jovian League.

A business meeting was held at the usual place this week. After considerable discussion the proposed amendment to the constitution providing for bi-monthly meetings in lieu of the present weekly meetings was held over for one month. A motion was carried to the effect that the Society for Electrical Development Inc., be requested to advise the league as to the campaign which they intend to follow on the Pacific Coast. Other matters of interest to the league were also discussed.

Utah Electric Club.

At the weekly luncheon of the Utah Electric Club at the Commercial Club Thursday, March 5th, Miss Mary Alisparo and Miss Josephine Betts, employes of the Mountain States Telephone & Telegraph Company, furnished a musical program while luncheon was being served.

The talk of the day was given by Dorsey A. Lyon, acting chief metallurgist of the U. S. Bureau of Mines, on the subject: "The Electric Furnace, and Its Application in Electro-Chemistry and Electro-Metallurgy."

The Society for Electrical Development.

New York, March 12th, 1914.—The Executive Committee met yesterday and activities of the Society were thoroughly discussed. The following committee, which is to meet March 17th, has been appointed to decide on final plans and to put them into effect: Henry L. Doherty, New York; W. H. Boynton, Cleveland; George Williams, New York; J. Robert Crouse, Cleveland; W. E. Robertson, Buffalo; E. W. Lloyd, Chicago; F. H. Gale, Schenectady; J. C. McQuiston, Pittsburg; J. R. Strong, New York; J. M. Wakeman, and S. L. Coles.

Jovian Electrical League of Southern California.

The members to the number of 100 were addressed at their weekly luncheon on March 4th, by ex-Senator R. F. Del-Valle, president of the board of public service commission. This interesting "native son" and descendant of a distinguished Spanish family talked most entertainingly for a half hour on "Hospitality" at the time of the Dons and at present and related a number of his early personal experiences which were highly appreciated by the audience.

In response to a telegram to Mr. Edison, congratulating him on the occasion of his 67th birthday on February 12th last, the following autograph letter was received by Chairman Colkitt from Mr. Edison:

"Dear Mr. Colkitt:—Allow me to express my thanks to you and to the Jovians of Los Angeles and to the members of the Jovian Electrical League for your kind congratulations on my birthday. I appreciate very greatly your courteous remembrance of the occasion. Yours very truly,

(Signed) THOMAS A. EDISON.

ELECTRIC JOBBERS AT DEL MONTE.

The Pacific Coast Electrical Supply Jobbers' Association and their guests held a most successful and pleasant meeting at Del Monte, California, March 5, 6 and 7. The attendance was over seventy and included a number of notables from the East.

One of these, W. W. Low, president of the Electric Appliance Company of Chicago, carried off the principal honors in the golf tournament, winning the Patton, the Jobbers' and the Del Monte cups with a gross score of 114 strokes and a handicap of —18.

In the Manufacturers' tournament F. H. Murray of the National Carbon Company won the manufacturers' and the Del Monte cups with a gross of 120 and a handicap of —18. The pool tournament was won by F. N. Averill of the Fobes Supply Company.

The presence of sixteen ladies added greatly to the enjoyment of the occasion and in addition to automobile rides, dances and other amusements, a putting contest was held for their edification. This was won by Mrs. Walter H. Seaver. Mrs. W. W. Low was the winner in the bridge game and Mrs. H. B. Squires in the 500 game.

At the general meeting on Saturday afternoon, W. W. Low discussed the business difficulties of the jobber. In the course of a clear-cut analysis of the cost of conducting a jobbing business, he showed that the percentage of profit on many articles was not sufficient to meet this cost. His remarks constituted a strong plea for sane merchandising of electrical goods. In the discussion that followed, W. L. Goodwin contended that prices should be based upon the cost of handling. Fred Skeel stated that there can be a profit only when price is based on cost. C. E. Wiggin cited some interesting facts and W. S. Berry showed how jobbing costs could be reduced by allowing the small dealers to sell to central stations, electric railways, and so forth. W. L. Goodwin further questioned the practice of differential prices to contractors and fixture dealers, contending that every man who buys for re-sale should have the same profit.

Chairman H. V. Carter also brought up the subject of the Society for Electric Development, calling upon W. W. Low for a statement as to its work. Mr. Low stated the organization had started its active campaign on the 1st of March, and was preparing a series of articles for the trade publications in different industries, and was also working to establish more harmonious relations between the central station and the contractor. A. D. Page of the Edison Lamp Works of the General Electric Company stated that the directors and officers of the society have underwritten the amount necessary to complete the $200,000 minimum fund, with which this campaign is being launched. He also outlined the lamp companies' practice in selling lamps direct to the consumer and in determining the proper cost of merchandising lamps. A. H. Halloran told of the proposed work of the society on the Pacific Coast.

The regular golf dinner was held on Saturday evening, with W. W. Leggett as toastmaster. The various trophies were presented to the victors, and a hearty welcome extended to the Eastern visitors.

The following were in attendance:

Jobbers.

F. N. Averill, Fobes Supply Company, Portland, Ore.
Harry Byrne, North Coast Elec. Company, Seattle, Wash.
W. S. Berry, Western Elec. Company, San Francisco.
T. E. Burger, Western Elec. Company, San Francisco.
C. H. Carter, Pacific States Elec. Company, Los Angeles.
H. V. Carter, Pacific States Elec. Company, San Francisco.
J. I. Colwell, Western Elec. Company, Seattle, Wash.
Albert H. Elliot, Secretary, San Francisco.
W. S. Goodwin, Pacific States Elec. Company, San Francisco.
C. L. Gilson, Gilson Elec. Company, Oakland, Cal.
C. B. Hall, Illinois Elec. Co., Los Angeles.
R. D. Holabird, Holabird, Reynolds Elec. Co., San Francisco.
Ross Hartley, Pacific States Elec. Company, Portland, Ore.
C. C. Hillis, Elec. Appliance Company, San Francisco.
F. N. Killam, Pacific States Elec. Company, Seattle, Wash.
F. H. Leggett, Western Elec. Company, San Francisco.
W. W. Low, Elec. Appliance Company, Chicago, Ill.

Duncan Reynolds, Holabird, Reynolds Elec. Co., Los Angeles.
Samuel Taylor, Elec. Ry. & Mfs. Sup. Co., San Francisco.
C. E. Wiggin, Dunham, Carrigan & Hayden Company, San Francisco.

Ladies.

Mrs. T. E. Bibbins
Mrs. W. S. Berry
Mrs. A. H. Elliot
Miss Elliot
Mrs. S. B. Gregory
Mrs. A. H. Halloran
Mrs. J. H. Herr
Mrs. C. C. Hillis
Mrs. C. E. Heise
Mrs. F. H. Leggett
Mrs. Harold Lauritzen
Mrs. R. F. Oakes
Mrs. Duncan Reynolds
Mrs. W. H. Seaver
Mrs. H. E. Sanderson
Mrs. H. B. Squires

Manufacturers.

Adams, Harry, Phillips Ins. Wire Co., Pawtucket, R. I.
Alvord, R. M., General Electric Co., San Francisco.
Bibbins, T. E., General Electric Co., San Francisco.
Cary, Walter, Westinghouse Lamp Works, Pittsburgh.
Case, J. O., General Electric Co., Los Angeles.
Cole, John R., John R. Cole Co., San Francisco.
Colwell, J. I. Western Electric Co., Seattle, Wash.
Cott, W. A., General Electric Co., Los Angeles.
Deming, W. M., General Electric Co., Schenectady.
Davis, R. J., Van Emon Elevator Co., San Francisco.
Fagan, Frank, General Electric Co., San Francisco.
Gregory, S. B., Arrow Electric Co., San Francisco.
Hills, Chas. L., Franklin Electric Lamp Co., New York.
Hall, W. Brewster, Pass & Seymour, San Francisco.
Herr, J. A., Sprague Electric Works, San Francisco.
Halloran, A. H., Journal of Electricity, San Francisco.
Heise, C. E., Westinghouse Elec. & Mfg. Co., San Francisco.
Kirkland, H. B., American Conduit Mfg. Co., Pittsburgh.
Kumler, Frank, General Electric Co., Portland.
Kuhn, Frank, American Electric Heating Co., Detroit.
Lauritzen, Harold, Holophane Works, San Francisco.
Murray, F. H., National Carbon Co., Los Angeles.
Moody, A. S., General Electric Co., Portland.
Morris, J. M., Westinghouse Elec. & Mfg. Co., Los Angeles.
Oakes, R. F., American Everready Co., San Francisco.
Osborne, L. A., Westinghouse Elec. & Mfg. Co., Pittsburgh.
Page, A. D., Edison Lamp Works, Harrison, N. J.
Poss, Fred, Benjamin Electric Co., San Francisco.
Pounder, W. R., Hubbard & Co., San Francisco.
Plank, H. E., General Electric Co., Seattle.
Quinn, Frank, Manhattan Elec. Supply Co., San Francisco.
Russell, S. P., H. W. Johns-Manville Co., San Francisco.
Seaver, W. H., American Steel & Wire Co., San Francisco.
Sanderson, H. E., Bryant Electric Co., San Francisco.
Squires, H. B., H. B. Squires Co., San Francisco.
Skeel, Fred, Crouse-Hinds Co., Chicago.
Scranton, D. H., American Electric Heating Co., Detroit.
Vandegrift, J. A., Oakland Warehouse Co., Oakland.
Zorn, F. J., General Electric Co., Seattle.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The Hermosa Beach Water Company has filed an application with the commission asking permission to withdraw from the territory embraced within the limits of the city of Manhattan Beach, Los Angeles county. The city of Manhattan Beach voted a bond issue of $116,000 with which to construct a municipal waterworks, and according to the application, has declined to negotiate for the purchase of the applicant's property.

The city of Claremont, Los Angeles county, has transferred the jurisdiction over its public utilities to the railroad commisison.

The San Joaquin Light & Power Corporation has applied to the commission for authority to issue $3,145,000 of bonds for the purpose of refunding underlying bonds. The company also asks for authority to refund $200,000 in short term notes.

The Southern Counties Gas Company applied to the commission for authority to issue $115,000 in bonds and to use the proceeds for the purpose of building a pipe line from the natural gas fields in the Olinda District, Orange county, to serve the cities of Placentia, Fullerton, Anaheim, Olive, Orange, McPherson, El Modena, Santa Ana, Garden Grove and Tustin. The company also asks for authority to refund notes in the sum of $16,000.

The Western States Gas & Electric Company has filed an application with the Railroad Commission for authority to issue $219,000 first mortgage refunding five per cent gold bonds which the applicant wishes to sell at eighty-two and one half per cent.

The commission has granted the application of the Central California Gas Company to issue bonds of the face value of twelve thousand dollars, bearing six per cent per annum, under the terms of its general mortgage to the Los Angeles Trust & Savings Bank; and also one thousand three hundred dollars of preferred stock and twelve thousand five hundred dollars common stock.

IDAHO PUBLIC UTILITIES COMMISSION.

The commission found that the Beaver River Power Company had not obtained from the commission a certificate of public convenience and necessity covering the sale of energy for light and power purposes in the city of Pocatello. The Beaver River Power Company had commenced construction of a distribution system under a franchise granted by the city. This was found by the commission to be in contravention of the state laws, and the company was ordered to immediately discontinue construction until further ordered.

The Northern Idaho & Montana Power Company was permitted to establish flat rates for electric lighting on less than statutory notice requirements, providing for a combination heating and power rate for laundries of 2½ cents per kw.-hr., subject to a discount of 10 per cent and to a monthly minimum rate of $2 per connected kw. The order was granted, and the rate became effective at once.

The Washington Water Power Company was similarly permitted to establish flat rates for electric lighting in the Coeur d'Alene Mining District of Northern Idaho, to apply to remote and isolated districts.

The Kootenai Power Company, Limited, was permitted by the commission to file a new schedule of rates, applying to the city of Coeur d'Alene. These were ordered effective as from March 1st.

The Idaho-Oregon Light & Power Company was permitted to file at less than statutory notice, a complete schedule which materially reduces the rates and charges heretofore made by the company. These changes were also made effective as from March 1, 1914.

The commission ordered that the Idaho Power & Light Company refrain from further constructing its distribution system in the city of Twin Falls, and that it refrain from furnished any consumer in the city of Twin Falls any electrical energy until further ordered.

TRADE NOTES.

The Bowie Switch Company, Nevada Bank Building, San Francisco, has been appointed selling agents for Flint & Walling Manufacturing Company, Kendallville, Ind., manufacturers of transmission line towers and special steel equipment.

Orders for the remainder of the electrical apparatus to be used in P. P. I. E. buildings and on the grounds, will be placed soon. The draughting department is now making a final check of lists to determine the quality and character of apparatus required.

The plans and specifications for the electrical work for the California Building are almost completed. The contract for the electrical work in the Court of Palms and the Court of Flowers has been awarded to Newbery Bendheim Electric Company.

An order was placed during the past week with the Wheeler Reflector Company, Boston, Mass, for 2154 steel reflectors varying in size from 7 to 11 in., to be used at the P. P. I. E. They are to be lacquered aluminum finish and will be used in the various exhibit palaces.

At the Panama-Pacific Exposition, to be held at San Francisco, in 1915, the National Lamp Works of General Electric Company will have a space 90 ft. by 20 ft. in which the most modern methods of feeding factory employes will be demonstrated by Mr. L. H. Brittin, manager of the company's general service department, and assistants. As evidenced by the award of the grand prize at the recent International Exhibit of Factory Safety and Sanitation Devices in New York City, the National Lamp Works' system of factory betterment work is now generally recognized as one of the most successful and most scientifically planned of any that has thus far been developed.

INDUSTRIAL

ELECTRIFICATION OF THE BUTTE, ANACONDA & PACIFIC RAILWAY.

The Butte, Anaconda & Pacific Railway is, in many ways, the most remarkable example of steam road electrification in this country. Besides being the first 2400 volt direct current road, it is also credited with being the first steam road operating both freight and passenger schedules, to electrify its lines purely for reasons of economy. A number of steam railway electrifications have been made because of preemptory factors, such as terminal and tunnel operation or for rapid suburban service. This road, however, cannot be classed as an "enforced electrification," since no such special limitations have been the determining factors.

The first electric locomotives were put in service on this line May 28, 1913. During the first seven months of service, they made approximately 201,000 miles and hauled about 2,365,000 tons of ore.

The steam locomotive crews consisting of engineman and fireman easily acquired proficiency in handling the electric locomotives; in fact, two or three days' instructions from a competent electrical man were ordinarily sufficient. The change from steam to electric haulage was made without any change in the personnel of the train crews and without any delays or alterations in the schedule. The engineers, without exception, have expressed themselves as being greatly pleased with the easy operation of the locomotives.

The electrified lines of this system extend from the Butte Hill yard to the smelter, a distance of 32 miles. There are numerous sidings, yards, and smelter tracks that have been equipped with overhead trolley, making a total of about 95 miles on a single track basis.

The Butte, Anaconda & Pacific Railway is essentially an ore hauling road, the freight traffic from this source originating at the copper mines located near the top of Butte Hill. The main line division extends through a rough mountainous country, a distance of about twenty miles, with grades as high as 0.3 per cent. The east bound traffic consists in returning empty cars to the mines and the transportation of copper ingot to the Butte yards, where it is shipped over other roads to refineries.

Between the cities of Butte and Anaconda there is considerable local traffic, both passenger and freight. At Butte, the Butte, Anaconda & Pacific connects with the Great Northern Railway, the Northern Pacific, and the Chicago, Milwaukee & St. Paul Railroad; and at Silver Bow, about six miles from the city, connection is made with the Oregon Short Line.

For a distance of 16 miles, the Butte, Anaconda & Pacific Railway is paralleled by the transcontinental lines of the Northern Pacific, and the Chicago, Milwaukee & St. Paul. The last named company has already contracted for power for the operation of electric trains from Harlowton, Montana, to Avery, Idaho, a distance of 440 miles.

The maximum curvature on the system (20 degrees, 285 ft. radius) occurs on the Butte Hill line. On this part of the road, there is an average curvature of 6 to 10 degrees. The locomotives are designed with sufficient flexibility to take a curve of 31 degrees (180 ft. radius) at slow speed.

Condensed Information of Freight Movement.

	West Bound.			East Bound.		
	Butte Hill Line.	Main Line.	Smelter Hill.	Smelter Hill.	Main Line.	Butte Hill Line.
Trailing load in tons..	2000	4000	1400	1000	1260	650
Number of cars.....	30	60	20	55	70	35
Number of 80-ton locomotives per train ...	2	2	2	2	2	2
Approx. grade against load	2.5%	0.3%	1.1%	1.1%	1%	2.5%
Approx. speed on level tangent track, m.p.h.		21			25	
Approx. speed on Max. grade	12	16	16	20	16	16
Average trolley voltage	2200	2200	2200	2200	2200	2200
Length of run in miles.	4.6	20.1	7	7	20.1	4.6



Map of Electrified Section,—Butte, Anaconda & Pacific Railway.

Single locomotives are used, hauling trains of from three to five passenger and baggage cars.

Energy for the operation of electric trains is purchased from the Great Falls Power Company. The generating plant is located at Great Falls, Mont., on the Missouri River, and has for some time been supplying electric power for the operation of the mines and smelters at Butte and Anaconda. Six hydroelectric units are installed, having a nominal rated capacity of 21,000 kw. The machines are of the horizontal type, generating 6600 volts, 3-phase, at a frequency of 60 cycles. The power is stepped up to 102,000 volts for transmission to the transformer substation at Butte, a distance of 130 miles, over two separate parallel lines constructed on the same right-of-way. An extension of the system transmits power at 60,000 volts to a second transformer station at Anaconda, 26 miles farther on.

The Butte station forms the center of the extensive power system operated by the Montana Power Company. Besides the Great Falls 102,000 volt transmission lines, there are several 60,000 volt transmissions terminating at this point, which form a part of the Montana Power Company's system. These lines bring in power from the Hauser Lake, Canyon Ferry, Madison and Big Hole plants. At the Butte substation, this power is stepped down to 2400 volts, 3-phase, and all of these lines are tied in on the 2400 volt a.c. bus. Ample protection is therefore afforded from the interruption of service.

The two existing substations at Butte and Anaconda were used to house the 2400 volt motor-generator sets required for operating the electric trains, so that no additional buildings were constructed for this purpose. Power is furnished by two 1000 kw., 3-unit motor-generator sets in each substation, taking power from the 2400 volt a.c. buses. These units operate continuously 24 hours per day, seven days of the week, to supply the necessary current for train operation. Each set consists of a 3-phase, 60 cycle, 1450 k.v.a, 720 r.p.m. synchronous motor direct connected to two 500 kw., 1200 volt generators, insulated to operate in series for 2400 volts. The generators are compound wound and have both commutating poles and compensating pole face windings. These fields are connected on the grounded side of the armature, and the main fields are separately excited from 125 volt exciters.

An automatic voltage regulator is used to maintain an approximately constant voltage at the terminals of the motor by power factor regulation. The motors are protected against overload by inverse time limit relays, which are set to open at four times normal load. These relays have been adjusted to open under sustained overload in about two seconds and upon short circuit their action is practically instantaneous.

Excitation for the two generating units in each substation is obtained from two induction motor driven sets, rated 50 kw. each at 125 volts.

The 2400 volt switchboards for controlling these sets are first direct current boards to be constructed for this high the voltage. In general, they are similar to the standard 600 volt types with increased insulation and special provision for interrupting the 2400 volt current. The circuit breakers and switches are also arranged for remote control, and all apparatus on the panels is provided with ample insulation to insure safety to operators.

Overhead Construction.

The overhead construction for this system was especially designed to give the flexibility necessary for satisfactory operation of the pantograph trolleys used. The 4/0 grooved copper trolley used over all tracks is supported by an eleven point catenary suspension from a stranded steel messenger cable. Both side bracket and cross span construction are used as required by the local conditions. There is a large amount of special work on account of the many yards and sidings, and in one case twelve tracks are spanned.

The alternating current switchboard contains two panels for controlling the synchronous motors by means of remote The cross span construction used at this point is supported by a third pole between the eighth and ninth tracks. The hanger used on the straight line construction is a rolled steel strap looped over the messenger wire. This loop is closed at the car and the wire is clamped in place by a single bolt. Special pull-offs are used to increase the flexibility of the suspension.

The section breakers were designed for the 2400 volt service, and at six points insulated crossings are necessary at the intersection of the 2400 volt trolley with the 600 volt trolley of the city system. On the main line a very simple section insulator is used. This consists of paralleling the two trolley wires from the ends of each section at a suitable distance for insulation so that the pantograph bridges the two circuits for a short distance, thus avoiding interruption of the power supply to the locomotive. The construction in the yards and sidings is simplified by paralleling the trolley from the side tracks for a short distance along the main line. This avoids the use of switch plates or similar devices. At some of these junction points the pantograph engages as many as six trolley wires.

The overhead lines are protected from lightning by 2400 volt d.c. type ME arresters installed on poles at intervals of one-third of a mile the entire length of the system.

Locomotives.

The locomotive equipment consists of seventeen (17) 80 ton units, fifteen for the freight and two for passenger service. The freight locomotives are geared for slow speed and are operated in pairs for the main line service. The maximum free running speed is 35 m.p.h.

The two passenger locomotives of the same construction are geared for a maximum free running speed of 55 m.p.h. A speed of 45 m.p.h. is made with three passenger coaches on straight level track.

A continuous tractive effort of a single 80 ton freight locomotive is 25,000 lb. at 15 miles per hour. The maximum tractive effort for a period of five minutes is 48,000 lb. based on a tractive coefficient of 30 per cent.

The motors are of the GE-229-A commutating pole type, wound for 1200 volts and insulated for 2400 volts. This motor was designed for locomotive service and is provided with forced ventilation. The method of ventilation is similar to the well known ventilated motors, but the volume of air circulated is increased by the use of an auxiliary blower. The gear reduction on the freight locomotive is 4.84 and on the passenger locomotive 3.2. The double unit, 160 ton locomotive is capable of giving a continuous sustained output of 2100 h.p. The motors are connected to the driving wheels by twin gears.

The control equipment is Sprague-General Electric Type M, multiple unit, operating the four motors in series and in series-parallel. Two 1200 volt motors are permanently connected in series. The controller provides ten steps in series and nine in series-parallel. The transition between series and series-parallel is effected without opening the motor circuit, and there is no appreciable reduction in tractive effort during the change. The transfer of circuits at this point is made by a special change-over switch, which is operated electro-pneumatically.

The 2400 volt contactors are operated from the 600 volt control circuit, and are specially constructed to separate the 2400 volt parts from the coils and interlocks which carry the 600 volt current. The necessary insulation is obtained by large clearances and by the use of porcelain and mica insulation. The armature is connected to the contact lever by a wooden rod. The contacts, magnetic blowout and arc chutes are also especially designed to rupture the 2400 volt arc.



Two Unit Electric Locomotive Hauling Freight Train.

Current is collected by overhead roller pantographs, pneumatically operated and controlled from either engineer's compartment by an air valve. A 2400 volt insulated bus line runs along the center of the cab roof. These bus lines are connected together by couplers between the two freight units, so that current may be obtained from either one or two collectors. The air brakes are the combined straight and automatic type; and the compressor is of the CP-26, 600 volt type, having a piston displacement of 100 cu. ft. of air per minute when pumping against a tank pressure of 135 pounds. Radiating pipes are provided on the roof of the cab for reducing the temperature of the compressed air before it reaches the high pressure cylinder.

For operating the control equipment and air compressor and for lighting the locomotive and cars, 600 volt current is supplied from the 2400/600 volt dynamotor installed on each locomotive.

The load furnished by the direct connected blower supplies sufficient current in the series field windings to provide for the necessary excitation, so that no shunt windings are required. The blower which supplies ventilating air to the motors consists of a multivane fan mounted on an extension of the dynamotor shaft. It has a capacity of 7200 cu. ft. per minute at 4 in. pressure.

The principal data and dimensions applying to the locomotives are the following:

Electric Locomotive Data.

Length inside of knuckles	37 ft. 4 in.
Length over cab	31 ft.
Height over cab	12 ft. 10 in.
Height with trolley down	15 ft. 6 in.
Width overall	10 ft.
Total wheel base	26 ft.
Rigid wheel base	8 ft. 8 in.
Track gauge	4 ft. 8½ in.
Total weight	160,000 lb.
Weight per axle	40,000 lb.
Wheels, steel tired	46 in.
Journals	6 in.x13 in.
Gears, forged rims, freight locomotives	87 teeth.
Gears, forged rims, passenger locomotives	80 teeth.
Pinions, forged, freight locomotives	18 teeth.
Pinions, forged, passenger locomotives	25 teeth.
Tractive effort at 30 per cent coefficient	48,000 lb.
Tractive effort at one hour rating	30,000 lb.
Tractive effort at continuous rating	25,000 lb.

The locomotives have been maintained by the regular shop force with the assistance of one man experienced in electrical apparatus.

Standard 600 volt lighting fixtures are used on the cars, and each passenger and baggage coach wired for five groups of five lamps in series. The lights in each car are controlled by a suitable master switch and fuse with snap switches in the individual circuits. Thirty-six watt railway type Mazda lamps are used, giving about 26 c.p. at 110 volts per lamp. Lighting current will be taken from a 600 volt train line bus, which is connected to the dynamotor on the locomotives.

All of the passenger and baggage cars now used between Butte and Anaconda will be heated as well as lighted by electricity as soon as the equipment can be installed.

All apparatus for the electrification of this road was furnished by the General Electric Company of Schnectady, New York.

A CATALOGUE DE LUXE.

The Crouse-Hinds Company of Syracuse, N. Y. has just issued Catalog No. 1000 on Condulets, which sets what is believed to be the highest standard ever reached in a trade publication. This 200 page, cloth bound volume, 9 by 12 in., is magnificently printed in four colors on heavily coated stock. A complete illustrated description of every kind of device manufactured by the company is conveniently shown in its natural colors, brass screws, copper contacts and aluminum covers being as distinct as cast iron bases.

This text opens with a three-way pictorial index, its 18 pages giving a complete display of the line. The index is arranged alphabetically as to types, numerically as to families and pictorially as to uses. The catalogue constitutes a liberal education for any electrical contractor or supply man. Its merits and novelties are so numerous that only a few can be mentioned here.

In addition to the standard lines of condulets have been added a full line of covers and fittings which will take any number of switches or receptacles. A new type of service entrance condulets provided with protective fuses and a padlock is shown for the first time. Two pages are devoted to a complete list of makes of fittings which can be used with condulets. Much space is devoted to bodies with "obround" and elliptical openings as well as to condulets which can be used under water and in places where destructive vapors abound. Among the thousands of new lines listed are a complete line of housings for railway work, both steam and electric. Fixtures complying with the U. S. postal requirements are fully illustrated together with a complete line to care for police, wire and marine requirement, as well as portable telephone systems for railway dispatching. Other valuable features are the house numbering fixtures and a pilot light for electric ironing circuits.

The description in each case gives shipping weight, size of standard package and list price, together with information as to installation. This monumental work has only to be seen to be appreciated.

NEWS NOTES

INCORPORATIONS.

TONOPAH, NEV.—Articles incorporating the Colorado River Hydroelectric Company, with principal offices located at Tonopah, have been filed. The capital is $5,000,000 and the incorporators are Henry C. Schmidt, W. R. Williams, and William Forman of Tonopah. This is the company which recently secured valuable water rights on the Colorado River near the Nevada line, with the intention of harnessing a portion of the flow of the river to create and supply power to southern Nevada and Arizona.

ILLUMINATION.

GLOBE, ARIZ.—The city council has decided to place petitions in circulation to secure signatures in favor of an election to determine whether or not to construct a municipal electric light plant.

GLENDALE, CAL.—The board of trustees will receive bids up to March 16 for furnishing material and installation of a lighting system in Ornamental District No. 3, and Ornamental District No. 4 in the city of Glendale.

GLENDORA, CAL.—A franchise has been awarded to the Pacific Light & Power Company granting right to construct and maintains for 40 years, an electric pole and wire system for lighting and power purposes in Glendora.

HOMEDALE, IDAHO.—The Homedale Water, Light & Power Company has petitioned the public utilities commission for a certificate of public convenience and necessity to enable it to furnish this city with light and water for domestic, fire, sprinkling, sanitary and other general uses. The company is incorporated for $50,000.

PHOENIX, ARIZ.—With preliminary steps now under way and assurance from the United States reclamation service that electric power can be secured from them in any quantity and at minimum rates municipal ownership of the electric lighting and gas system of Tempe seems assured. The proposition will be submitted to the voters in the form of a bond election in the near future.

SEATTLE, WASH.—Suit was begun in the federal court recently by the Olympic Foundry Company against the Westerman Iron Works, alleging infringement of a patent on the five-light cluster lamp post design invented in 1910 by J. D. Ross, superintendent of lighting, and demanding an accounting of all the ornamental electric street lamp posts manufactured by the defendant. The foundry company claims, by virtue of an assignment from Mr. Ross, an exclusive half interest in the patent.

SALT LAKE CITY, UTAH.—A special committee consisting of twenty-two prominent club women representing the Association of City Clubs, have been investigating conditions in Salt Lake City school buildings and have made numerous recommendations to the board of education with reference to the improvement of this feature of the public school system. Among these is included the suggestion that many class rooms are inadequately lighted, and that the board of education either provide an adequate system of illumination for these rooms, or that they be abandoned for class purposes. They recommend that a vacuum cleaner system be installed in the new high school building and in all other school buildings, and that adequate systems of forced ventilation be installed wherever necessary. It is interesting to note that in most of the recommendations of this committee, electricity offers a solution of the difficulties encountered which it is desired to remove.

RIVERSIDE, CAL.—The city council at its next meeting will recommend a reduction in electric rates that provides, among other alterations, from established schedules, the lowest schedule for industrial power that has so far been filed with the state railroad commission by any corporation supplying power for this purpose. The board of public utilities, after long deliberation over a revision in the schedule for lighting and power rates, is now ready to submit its recommendations, which are as follows:

METER RATES FOR LIGHTING.

First 150 kw.-hr. per mo	7c per kw.-hr.
Next 100 kw.-hr. per mo	6c per kw.-hr.
All additional, per mo	4c per kw.-hr.

DOMESTIC POWER RATES.

First 500 kw.-hr. per mo	3c per kw.-hr.
All additional, per mo	2c per kw.-hr.

PUMPING RATES.

First 100 kw.-hr. per mo	1½c per kw.-hr.
Next 100 kw.-hr per mo	1 4-10c per kw.-hr.
All additional, per mo	1¼c per kw.-hr.

TRANSMISSION.

CANBY, ORE.—M. J. Lee of this city will build a $25,000 power plant near Molalla this spring. All the machinery required has been purchased and work will begin immediately.

SOUTH PASADENA, CAL.—January, 1921, has been set as the final date for the elimination of poles and wires from the streets of South Pasadena, according to an ordinance passed recently.

LOS ANGELES, CAL.—The council has adopted the proposal of the special power committee that the negotiations be broken off with the power companies. Steps are now being taken to hold an election at the earliest possible date for the people to vote on a $6,500,000 bond issue to be utilized for the purposes of completing the power plant, the interest cost of which to the city is now stated to be $4000 per day, and for the acquisition or construction of a distributing system.

PORTLAND, ORE.—The stockholders of the Northwestern Electric Company will hold a special meeting on April 8th, to authorize an increase of the capital stock of the company to 120,000 shares at a par value of $100 a share, making a total capitalization of $12,000,000. Of this amount, 20,000 shares, representing $2,000,000 capital, will be preferred stock, bearing interest at 6 per cent a year. The trustees of the company are Herbert Fleishhacker, M. Fleishhacker and R. E. Wallace.

TRANSPORTATION.

OAKLAND, CAL.—The stockholders of the Oakland, Antioch & Eastern Railway Company at a special meeting ratified an issue of $700,000 4 year 6 per cent convertible notes.

OAKLAND, CAL.—Rejecting all offers of compromise the Albany board of trustees has demanded the forfeiture of $5000 by the Oakland Traction Company for failure to construct the Albany extension within the time granted in the franchise of 1910.

BLYTHE, CAL.—A new electric railroad through the Parker Indian Reservation, the survey for which is now being made, will probably be built in the near future. The line will run from Parker, Arizona, to Ehrenberg, with possible extensions into Palo Verde valley and Cibola valley.

NORTH YAKIMA, WASH.—The North Yakima & Valley Railway will build an extension of seven miles in the Cowiche to the Tieton postoffice and will extend the reservation branch to White Swan this year, according to Superintendent J. O. Roth. The work will cost about $300,000. Improvements of existing lines will cost about $30,000.

PASADENA, CAL.—D. J. McPherson, engineer, engaged by the city to make the preliminary survey for the proposed municipal railway between Pasadena and Los Angeles via Arroya Sedro Canyon, has submitted his report to the city commissioners. According to the report, the cost will be $2,089,164 to build and equip the line, which will be 10 miles long.

SEATTLE, WASH.—That there has been a noticeable improvement in business conditions for the first two months of 1914 over the same period of last year, is indicated by the revenues of the Puget Sound Traction, Light & Power Company for the month of January, showing an increase for that period of $23,190.81, with but four lines showing less receipts than for January of last year and every other line showing a substantial increase.

SALT LAKE CITY, UTAH.—The Utah Light & Railway Company has gotten out a neat button bearing on its face the company's monogram and the words "Safety First." These buttons are presented by the company to the members of the "Safety First" committee, consisting of twenty-five employes of the company. This committee is changed at regular intervals. The retiring members retain their buttons, thus becoming ex-officio members of the Safety Committee.

PORTLAND, ORE.—Geo. F. Heusner plans to begin the immediate construction of the railway line outlined in the franchise which was granted him last fall. This calls for the construction of a single or double track broad gauge railway line from the city boundary at Patton avenue, near the approach to the proposed interstate bridge across the Columbia, and on various streets to the Broadway bridge, and on the west side it will loop Flanders, Tenth, Salmon and Fourth streets.

SAN FRANCISCO, CAL.—Plans are being considered for the private construction of a street railway to Hunter's Point to connect with the projected Potrero extension of the Municipal Railroad and to be operated by the syndicate of capitalists who have recently purchased 275 acres of waterfront land near the site of the naval base which the government is to establish at Hunter's Point. The capitalists who are interested in the project are C. de Guigne Jr., A. Schilling, H. T. McCloskey, C. O. Miller, F. W. Van Sicklen and Fred Morgan. They propose to build a trolley line about 1½ miles long from Hunter's Point to the Twenty-fifth street terminal of the municipal line, and to turn their line over to the city for operation as a part of the Municipal Railway. It is estimated that the Hunter's Point line will cost about $100,000. It will run principally over a private right of way.

SAN FRANCISCO, CAL.—The Public Utilities Committee of the supervisors has approved an ordinance directing the construction of the municipal railway lines included in the bond issue voted last year. Plans are ordered and the board of works is authorized to obtain bids. The lines are set forth as contemplated last year, with the exception of the Church street road, which is to built only to Dorland street. The War Department has been assured by the utilities committee that the municipal railway will be built through the Fort Mason reservation to the transport docks. The committee approved the United Railroads' new car plans, which resemble those for the new municipal railway cars. The United Railroads will order 65 new cars as soon as authorized by the railroad commission. The board of works has received bids for installing underground and overhead electric conductors for the Union street line. The lowest for the underground is that of the Pacific Gas & Electric Company, amounting to $5785, and the lowest for the overhead is the Pacific Fire Extinguisher Company's for $3200.

TELEPHONE AND TELEGRAPH.

YUMA, ARIZ.—There is a movement on foot to establish a telephone system in San Pascual valley. The instigators of the plan have in mind an independent company with the Bell Company of Yuma.

NEWPORT BEACH, CAL.—The board of trustees has advertised for sale a 50 year telephone franchise, to be sold April 20, by the terms of which the telephone company is to furnish free telephones to the city and pay the city 2 per cent of the gross income.

LA JOLLA, CAL.—The Pacific Telephone & Telegraph Company has leased the store room at 939 Wall street for a local exchange. Work will begin about April 1st on the installation of a new switchboard and business will begin in the new quarters about May 1.

SAN FRANCISCO, CAL.—The stockholders of the Pacific Telephone & Telegraph Company have elected the following directors: J. C. Ainsworth, E. C. Bradley, J. C. Cebrian, Wm. H. Crocker, F. G. Drum, F. W. Eaton, M. Ehrman, G. D. Greenwood, Timothy Hopkins, Homer S. King, Walter S. Martin, G. E. McFarland, H. D. Pillsbury, J. M. Quay, H. T. Scott, O. J. Woodward and Theo. N. Vail. The directors organized by electing the following officers: Henry T. Scott, chairman of the board; G. E. McFarland, president; H. D. Pillsbury and J. M. Quay, vice-presidents; F. W. Eaton, secretary and treasurer; F. C. Phelps, general auditor. The executive board is composed of Wm. H. Crocker, F. G. Drum, F. W. Eaton, Timothy Hopkins, Homer S. King, G. E. McFarland and Henry T. Scott, chairman.

WATERWORKS.

MILTON, ORE.—March 26th has been set as the date for voting on a $18,000 for the increasing of the light plans and the extension of the water system.

PORTLAND, ORE.—The commissioner of public utilities has been granted authority to advertise for bids and let the contract for 5000 water meters. The installation of meters is to begin at the rate of 1000 per month after April 1st.

EUGENE, ORE.—The Eugene water board has taken an option on a half block of land on College Hill on which to build one of the two reservoirs to be included in the improvements made this coming summer with the $100,000 to be derived from the bond sale. Work will start about April 1st on the water system.

SAN DIEGO, CAL.—Notice of appropriation of all waters of San Dieguito and San Ysabel rivers or waters to the extent of 10,000 miners' inches, has been filed with the county recorder by H. Taylor, who intends to construct a solid dam 150 ft. high across San Dieguito River and divert the water thus stored by means of pipes and flumes to adjacent lands.

BRAWLEY, CAL.—A resolution has been adopted by the board of trustees determining that public interest demands the acquisition and construction of municipal improvements to the water system, the cost of which is estimated at $35,000, and a bond election will be held soon to vote on the question of incurring a bonded indebtedness in this amount.

SAN DIEGO, CAL.—The water department's advisory committee, of which Rufus Choate, George W. Marston and Simon Levi are members, has recommended that the construction of a conduit between Morena dam and Barrett Intake be constructed by public contract. The estimated cost of the conduit is $185,000.

ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page opposite

A-1 American Ever-Ready Co.
Los Angeles; 755 Folsom Street, San Francisco; Seattle.

B-1 Benjamin Electric Manufacturing Co.
Rialto Building, San Francisco.

B-2 Berkeley Electric Cooker Co.
1932 Center Street, Berkeley.

B-3 Blake Signal and Manufacturing Co. 4
680 Howard Street, San Francisco.

B-5 Bridgeport Brass Co. 3
(See Pierson, Roeding & Co.)

C-1 Century Electric Co. 16
614 So. Grand Ave., Los Angeles; Salt Lake City; 56 Natoma Street, San Francisco; Seattle; Spokane.

C-2 Crocker-Wheeler Co. 11
Title Insurance Bldg., Los Angeles; Salt Lake City; First National Bank Bldg., San Francisco; Seattle.

C-3 Cutler-Hammer Manufacturing Co.
579 Howard Street, San Francisco; Morgan Bldg., Portland, Ore.; San Fernando Bldg., Los Angeles.

D-1 D. & W. Fuse Co.
(All Jobbers.)

D-2 Dearborn Drug and Chemical Works 11
355 East Second Street, Los Angeles; 301 Front Street, San Francisco.

E-1 Edison Lamp Works of General Electric Co.
(See General Electric Company.)

E-2 Edison Storage Battery Supply Co. 11
441 Golden Gate Avenue, San Francisco.

E-3 Electric Agencies Co.
247 Minna Street, San Francisco.

E-4 Electric Storage Battery Co.
Pacific Electric Building, Los Angeles; Spalding Building, Portland; 118 New Montgomery Street, San Francisco; Colman Building, Seattle; Pacific Building, Vancouver.

F-1 Fairbanks, Morse & Co.
Los Angeles; Portland; 651 Mission Street, San Francisco; Seattle; Spokane.

F-2 Fort Wayne Electric Works of G. E. Co. 12
Rialto Building, San Francisco; Colman Building, Seattle.

G-1 General Electric Co. 13-14
124 W. Fourth Street, Los Angeles; Worcester Building, Portland; Rialto Building, San Francisco; Colman Building, Seattle; Paulsen Building, Spokane.

H-1 Habirshaw Wire Co.
(See Western Electric Company.)

H-2 Hemingray Glass Co. 11
330 So. L. A. Street, Los Angeles; 345 Oak Street, Portland; 807 Mission Street, San Francisco.

H-3 Hoagland-Hulse Electric Co.
1707 Naud Street, Los Angeles.

H-4 Hunt, Mirk & Co.
141 Second Street, San Francisco.

I-1 Indiana Rubber and Insulated Wire Co. 16
807 Mission Street, San Francisco.

K-1 Kellogg Switchboard and Supply Co.
Aronson Building, San Francisco.

K-2 Keystone Boiler Works.
201 Folsom Street, San Francisco

K-3 Klein & Sons, Mathias. 5
579 Howard Street, San Francisco.

K-4 K-P-F Electric Co. 11
37 Stevenson Street, San Francisco.

L-1 Leaby Manufacturing Co.
Eighth and Alameda Streets, Los Angeles.

L-2 Locke Insulator Manufacturing Co. 3
(See Pierson, Roeding & Co.)

M-1 Mannesmannrohren-Werke 5
Rialto Building, San Francisco.

M-2 McGlauflin Manufacturing Co.
Sunnyvale.

M-3 Moore & Co., Charles C.
Van Nuys Building, Los Angeles; Spalding Building, Portland; Kearns Building, Salt Lake City; 40 First Street, San Francisco; Mutual Life Building, Seattle; Santa Rita Hotel Building, Tucson.

N-1 Nason & Co., R. N.
151 Potrero Avenue, San Francisco.

N-2 National Conduit & Cable Co., The
Trust and Savings Building, Los Angeles; Rialto Building, San Francisco.

N-3 National Lamp Works of G. E. Co. 15
(All Jobbers.)

N-4 New York Insulated Wire Co.
629 Howard Street, San Francisco.

N-5 Norris Co., L. A.
Monadnock Building, San Francisco.

O-1 Okonite Co. 16
(All Jobbers.)

P-1 Pacific Electric Manufacturing Co.
80 Tehama Street, San Francisco.

P-2 Pacific States Electric Co. 2
526 So. L. A. Street, Los Angeles; 90 Seventh Street, Portland; 526 Thirteenth Street, Oakland; 575 Mission Street, San Francisco; 307 First Ave., So., Seattle.

P-3 Parker Boiler Co.
201 Folsom Street, San Francisco.

P-4 Pelton Water Wheel Co. 11
2219 Harrison Street, San Francisco.

P-5 Pierson, Roeding & Co. 3-4
Pacific Electric Building, Los Angeles; Spalding Building, Portland; Rialto Building, San Francisco; Colman Building, Seattle; Pacific Building, Vancouver.

P-7 Pittsburg Piping & Equipment Co. 16
Monadnock Building, San Francisco.

S-1 Schaw-Batcher Company, Pipe Works, The
211 J Street, Sacramento; 356 Market Street, San Francisco.

S-2 Simonds Machinery Co.
12 Natoma Street, San Francisco.

S-3 Simplex Electric Heating Co. 16
612 Howard Street, San Francisco.

S-4 Southern Pacific Co. 4-11
Flood Building, San Francisco.

S-5 Sprague Electric Works of G. E. Co. 16
Rialto Building, San Francisco; Colman Building, Seattle.

S-6 Standard Underground Cable Co.
First National Bank Bldg., San Francisco; Hibernian Bldg., Los Angeles; Yeon Bldg., Portland, Or.; Central Bldg., Seattle, Wash.

S-7 Staples & Pfeiffer.
102 Steuart Street, San Francisco.

T-1 Thomas & Co., R.
(See Western Electric Co.)

V-1 Van Emon Elevator Co.
56 Natoma Street, San Francisco.

W-1 Wagner Electric Manufacturing Co. 5
Rialto Building, San Francisco.

W-2 Western Electric Co.
119 East Seventh Street, Los Angeles; 507 Sixteenth Street, Oakland; 680 Folsom Street, San Francisco; 1518 First Avenue, So., Seattle.

W-3 Westinghouse-Church-Kerr Co.
Pacific Electric Building, Los Angeles; Pacific Building, San Francisco.

W-4 Westinghouse Electric and Manufacturing Co. 6
50-52 East Broadway, Butte; Van Nuys Building, Los Angeles; Couch Building, Portland; 212 So. W. Temple, Salt Lake City; 165 Second Street, San Francisco; Central Building, Seattle; Paulsen Building, Spokane.

W-5 Westinghouse Machine Co.
141 Second Street, San Francisco.

W-6 Westinghouse Lamp Co.
(See Westinghouse Electric and Manufacturing Co.)

W-7 Weston Electrical Instrument Co. 3
682 Mission Street, San Francisco.

W-8 Western Pipe & Steel Co.
444 Market Street, San Francisco; 1758 North Broadway, Los Angeles.

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the act of Congress March 3, 1879.

VOL. XXXII NO. 12 SAN FRANCISCO, MARCH 21, 1914 PER COPY, 25 CENTS

SYSTEM OF HEATING AND LIGHTING BY GAS, P. P. I. E.
BY GUY R. KINSLEY.

ELECTRICITY AND MATTER.
BY DR. HENRY S. CARHART.

PRESERVATION OF POLES AND PILES.

A BANK LIGHTING INSTALLATION.

NEW AND PROPOSED REGULATIONS AFFECTING WATER POWER DEVELOPMENT.
BY L. F. HARZA.

MATERIALS ADVERTISED IN THIS ISSUE

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Boiler Feed Water Treatment
Dearborn Chemical Co.

Electrical Instruments
Weston Electrical Instrument Co.

Fans.
Pacific States Electric Co.
General Electric Co.

Heating Appliances
Simplex Electric Heating Co.

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Hemingray Glass Co.
Pierson, Roeding & Co.

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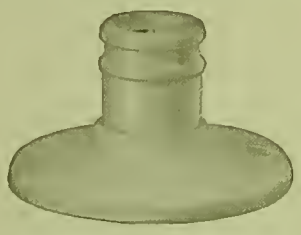
Wire (Trolley)
"Phono," Pierson, Roeding & Co.

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Alphabetical Index to Advertisers, Page 8 **Where to Buy It in the West, Page 9**

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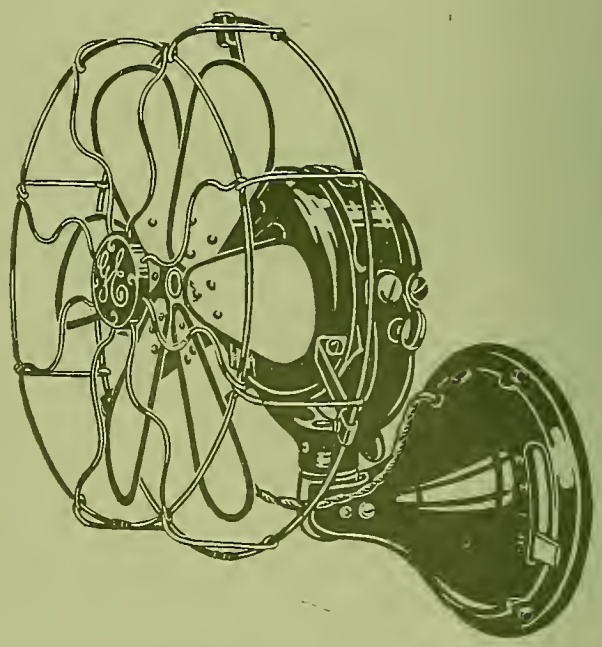
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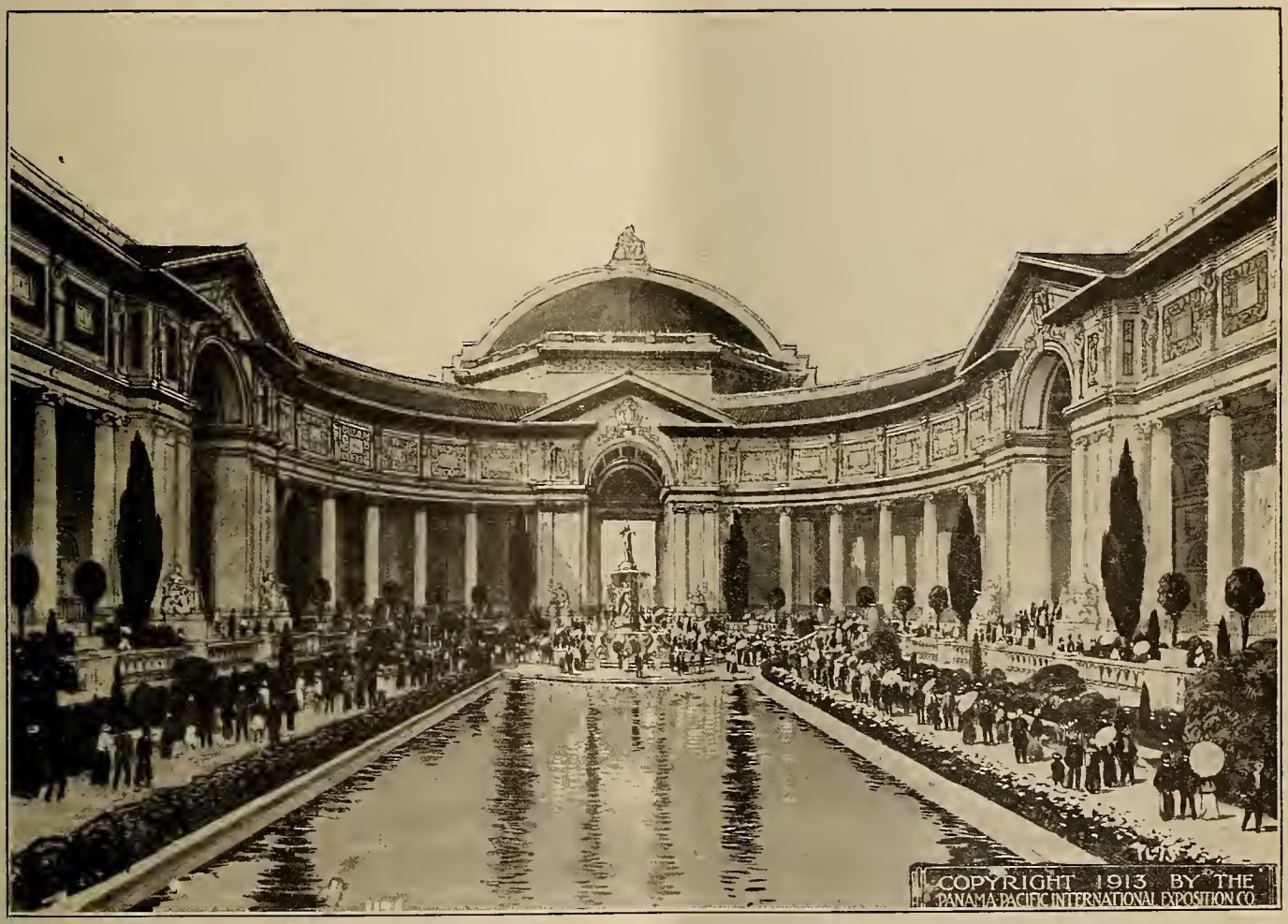
JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXII · SAN FRANCISCO, MARCH 21, 1914 · NUMBER 12

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The Court of Palms at the P. P. I. E. Gas Will Be an Important Factor in Its Illumination.

SYSTEM OF HEATING AND LIGHTING BY GAS — P. P. I. E.

BY GUY R. KINSLEY.

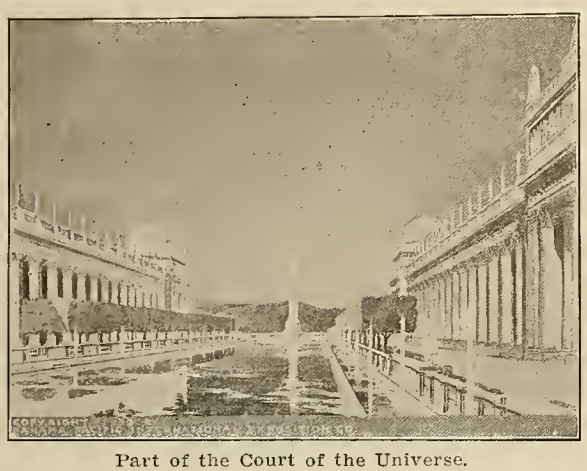
(There is described in this article the system of gas distribution to be used at the Panama-Pacific International Exposition, San Francisco 1915, and the extent to which gas will be used for street and ornamental lighting and for heating purposes, in connection with which a new system is mentioned.—The Editors.)

Gas is to be an important and versatile factor in the success of the Panama-Pacific International Exposition. Gas will share with Old Sol, who smiles perennially on San Francisco, and with the matured descendants of the modest electricity that Franklin lured to stay in New England, the glory of "enlightening" the world to its progress; to gas also falls the duty of driving the chill from the great buildings at night and feeding at any hour the hungry mouths that may crave any food from hot bouillon to a table d'hote dinner; added to these will be its part in the spectacular lighting effects that are to transform the various courts at night.

And then, as if these functions were not sufficient to employ one agency, gas will literally and figuratively "blaze" the way for the coming decade's progress in the science of heating and lighting and several tributary fields. The exposition is to be a

pathfinder for the latest inventions in these lines and for 10 months the grounds will be a vast experiment ground and station for the observation of world experts. And when this period is ended success or failure of the experiments will be emblazoned to every clime on the globe where civilization may bend a listening ear and turn a watchful eye.

The very system by which the 635 acres of ground are piped for the demands that are to be made in 1915 is a testimonial to the great advance that has been made in a branch of the gas distribution science that was almost unknown at the time of the Louisiana Purchase Exposition in 1904.



Part of the Court of the Universe.

St. Louis gas engineers engaged in solving the exposition's problem of gas supply at that time found the exposition removed from the center of gas distribution which placed them at a disadvantage for they had no large gas feeders. They depended on a low gas delivery under pressure from the St. Louis mains.

Since 1904 there have been rapid strides in the development of high pressure gas distribution both for direct service and for boosting or reinforcing low pressure systems. The Panama-Pacific International Exposition grounds are fortunately situated as far as gas delivery is concerned by being located directly on a high power loop extending from the gas works at the south end of the city almost around San Francisco to the North Beach holder station.

This loop is a 16 in. steel main and its approach to the North Beach is through Webster street, which is almost the spine of the exhibition grounds. From this 16 in. main is taken an eight in. steel loop extending completely around the grounds. Another loop of four inch steel pipe circles the state and pavilion sites. The portion of the exposition grounds east of Webster street, including the amusement concessions, will be supplied from an 8 in. steel loop.

The reason for extending these gas mains in the form of loops is to avoid what is generally known as "dead ends"; these are the terminals of gas mains farthest removed from the source of supply and these "dead ends" there is naturally a reduction in pressure according to the amount of gas taken from them until in the point most remote the pressure is low and the service unsatisfactory.

This refers mainly to low pressure gas distribution but would also apply in a measure to high pressure distribution. Experience of past expositions has proven the disadvantages of both low pressure and "dead ends."

By laying gas mains in loops returning to the source of supply equalizes the pressure and provides a system where the circuit of gas is perfect and the pressure uniform. Low pressure distribution is always considered as that force which is exerted on the gas by the weight of the gas holder or by rotary boosting fans and the pressure is measured in terms of inches of water in a syphon pressure gauge. Low pressure is commonly used for lighting, heating and cooking and the pressure is from four to six inches or about one-seventh to one-fifth of a pound per sq. in. This was the pressure of gas given other expositions that utilized gas on the grounds and buildings.

A requisite for low distribution which has been lacking in past systems is the laying of large mains. They should also be large enough for unusual demands.

All of these defects are obviated by the high pressure system installed at the 1915 exposition grounds. The gas is delivered into steel mains of smaller size under pressure measured by pounds per square inch and the pressure is reduced by a regulator at each consumer's meter to a pressure in inches of water necessary to give the best results for the particular purpose for which the gas is to be used.

For instance for ordinary incandescent gas light a pressure of from four to six inches is most satisfactory while for industrial uses pressure to as high as one pound may be employed with greater satisfaction and economy; and for the latest installation of high pressure power lamps for street lighting, such as are now used in London, Paris and Berlin, only, and which will be used for lighting the amusement streets at the exposition, a pressure of two pounds applied directly to the mantle gives the greatest lighting efficiency.

Another advantage of high pressure over low pressure is the ability to increase the supply of gas by increasing the initial pressure. In the low pressure systems the increase in demand can only be provided for by the installation of larger pipes or boosting the low pressure with consequent leakage of joints of cast iron mains.

And in this matter of joints and mains the system prepared by the Pacific Gas & Electric Company for the International Exposition is far in advance of any used anywhere whether in an exposition or community. The San Francisco company is the pioneer and the P. P. I. E. is the greatest demonstrator in the world of a loop system without joints. And it is a system of more than nine miles of pipe within the fence that encloses the world enterprise.

All the steel tubes are welded together by the oxy-acetylene torch using rods of Norway iron for the welding material. These welds are actually stronger than any other section of the great steel pipe and the mains when finished consist of an endless welded tube without leaks. They are tested for leaks under a pressure of 100 lb. per sq. in, and when they have proved to be tight under this pressure they will be absolutely tight under the working pressure of 40

lb. per sq. in., maximum, which will be supplied to the exposition.

The compressors are not capable of greater pressure on the exposition mains and the average pressure will be nearer 30 lb. On Geary street, San Francisco, the first strip of welded steel pipe ever laid for high pressure was installed but a comparatively short time since, and the exposition test will be of great value in further demonstrating the advantages of the new plan.

In the matter of measuring the gas supply for the exposition two of the latest meters will be used and scientific men will be able to watch this invention in an unusual test. Two Thomas electric gas meters will be used to record the flow of high pressure gas. The gas that passes through the meter is heated by means of an electric current and a careful measurement of the quantity of electricity employed and the rise in temperature of the gas, taken with the known specific gravity of oil gas supplies the factor for determining the exact quantity of gas used.

The gas that will be used is made from the California crude petroleum by a process which is itself Californian. It is produced from the oil with practically no by-products as is the case where coal gas is made. The gas is remarkably free from sulphur and other impurities. Its illuminating power is about 19 c.p. and it has a heat capacity always in excess of 600 B.t.u. per cu. ft. It is expected to provide an ideal fuel for heating, cooking, illuminating and all other purposes within the fair grounds coupled with convenience and safety which are not enjoyed when solids or liquid fuels are used.

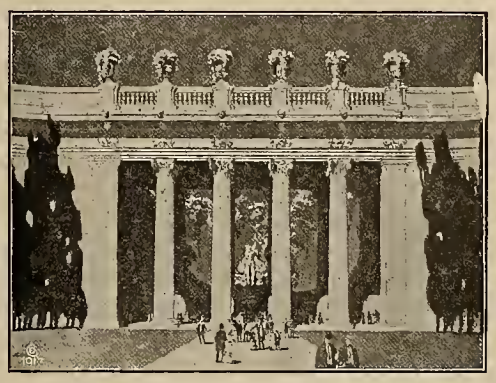
A part of the exposition lighting system will in fact be an exhibition of high pressure gas lamps to be used here in this country for the first time. They will be placed in the section of the grounds occupied by the state and foreign pavilions and on the concession streets. They will stand on a bronze upright and will be attractive even when not lighted.

In the Court of Abundance gas will have its greatest part in the spectacular features of the exposition. The theme is the creation and development of the earth and the history of man in symbol will be presented. Here the high pressure gas will be used in great flaring flambeau surrounding the lagoon in the center and lined against the fire-proof walls of the court. By the use of minerals distributed in the gas varied colors will be created which will cast their spell on the splendor of the scene.

Important to the exposition and to the scientific world as these uses of gas are to be its use in heating promises to excel all other. "Surface combustion" is something new in the scientific world and has never been given extensive use but if the plans of the exposition are consummated this development of the use of gas will be given a complete test which will advertise its merits to the world as no other means could do. "Surface combustion" is the use of heat from gas without flame. The distinguishing and essential feature of this process is that a homogeneous explosive mixture of gas and air, in the proper proportions for complete combustion, is caused to burn without flame in contact with a granular incandescent solid, whereby a large proportion of the potential energy of the gas is immediately converted into radiant form.

The advantages of the new system which the exposition test would fully determine are: that the combustion is greatly accelerated by the incandescent surface and may be concentrated where the heat is desired; the combustion is perfect with a minimum excess of air; high temperatures are possible without the aid of elaborate regenerative devices and as a matter of economy the originators claim for it twice the heat with half the cost.

In the heaters to be used for cooking there will be one great difference from all the stoves now designed to utilize the principle of "surface combustion." The exposition stove will not have the fan as the mixing of the gas will be accomplished without its use due to a later idea.



Part of the Court of Four Seasons.

This will be another utility which will be in the nature of the most interesting exhibit to the gas men of the world and especially to the scientists who first conceived the idea of "surface combustion."

Gas will also be used for patrol purposes and the grounds will be so well equipped with gas lighting that a complete suspension of electric power would leave the grounds well lighted. After the closing hours for the 10 months gas will be used until daybreak.

These are the things that the exposition will do with gas and the science that has been brought from the ends of the world to get the most out of its power. The many exhibits in the great exhibit palaces relating to manufacture and the various appliances for gas consumption will add to the interest of the world's greatest exposition to the minds of men trained to gas problems and gas rewards.

An electrical marine elevator constructed and installed by the port of Seattle, achieved the remarkable record, the first day of its use, of unloading 2273 bales of hay, aggregating 126 tons, from a steamship in the short space of three hours. It was estimated that under the old system of unloading by trucking up slips or inclines that this would have constituted a full day's work. Even better results are expected when the operators have more experience with the new equipment.

ELECTRICITY AND MATTER.

BY DR. HENRY S. CARHART.

(This is a popular exposition of the subject, having been given originally by Dr. Carhart as a lecture of the Throop College Extension Course at the Y. M. C. A., Pasadena, Cal. It is at once scientific and most clearly stated. The author traces the discoveries of Crookes, Roentgen, Becquerel, Madam Curie, and others, up to the ultimate electron.—The Editors.)

I am well aware that my subject is a difficult one; it does not lend itself readily to popular exposition and illustration. But it has intrinsic attractions, for men of philosophic mind have ever inquired into the nature and constitution of matter; not of forms and organisms alone, but of the ultimate nature of the material out of which the whole physical universe is made. I say the whole physical universe advisedly, for during the past century the spectroscope has revealed to us the existence in sun and stars of the same elementary substances that are present in the earth. Indeed, the discovery of helium in the sun preceded its discovery in the earth by thirty years, thus reversing in a most remarkable manner the order of identification of terrestrial and solar elements.

Interest in the inquiry relative to the nature of matter has been enormously stimulated by the revolutionary discoveries of recent years, made through the agency of electricity. In fact, more progress in this field has been made in the last thirty-five years than in any preceding century. The point of attack has been matter in the gaseous state, and the instrumentality, the discharge of electricity in high vacua. I hope to give in a brief way some of the successive steps by which these discoveries have been made.

It is now thirty-five years since Sir William Crookes made his epochal discovery of matter in what he aptly and prophetically termed the fourth, or ultra-gaseous, or radiant state. It was my good fortune to import in 1881 a full set of the famous Crookes tubes, and later in the same year to make the acquaintance of the celebrated discoverer at the Exposition of Electricity in Paris. The value placed on Crookes' discoveries in England is indicated by his recent election to the presidency of the Royal Society, "the highest honor attainable by an English man of science."

The discovery of X rays by means of Crookes tubes was announced by Roentgen in 1895. They are produced in some mysterious manner when cathode rays are suddenly stopped, especially by heavy substances like platinum. Their most striking properties are their ability to penetrate thin metallic sheets and other opaque substances, their effect on a sensitized photographic plate, and their power of exciting fluorescence in certain salts, especially platino-cyanides. It is by means of this flourescence that we are enabled apparently to look through opaque bodies.

The activities of X rays in promoting photographic changes led directly to the discovery of the radioactivity of uranium by Becquerel in 1896. Becquerel found that uranium salts give off spontaneously radiations capable of passing through black paper and thin sheets of aluminum foil, and affecting photographic plates, as X rays do. These radiations are not modified in any way by the most drastic physical treatment of the uranium, whether of heat or cold or other physical changes. You know that Madam Curie in the search for other radio-active substances discovered the most remarkable element known to science; I mean radium. One of the striking properties of radium is its ability to promote the discharge of electrified bodies. This means that the radiations from radium are able to ionize the air, that is, to resolve it into parts which are carriers respectively of positive and negative charges of electricity; for gases do not conduct electricity unless they are first ionized. The charged ions then move with their charges, thus conveying a current.

It is necessary at this point to make a slight digression for the purpose of describing the composite nature of the radiations from radium and similar bodies. There are three sorts of radiations from radium, which are known as alpha, beta and gamma-rays or radiations. None of these are rays in the sense in which the word ray is used in light, with the possible exception of the gamma-rays. The beta-rays have been identified with cathode rays in a Crookes tube. They consist of minute particles carrying or composed of the same quantity of negative electricity, and they are called electrons. They are the same whatever their source, and they travel with a speed of the same order as the velocity of light.

Alpha-rays are positively charged radiations, traveling with a much smaller velocity than that of the beta-rays. They have now been definitely identified with the atom of helium. Alpha-rays have only relatively slight penetrating power and are quickly absorbed.

Gamma-rays are unchanged or electrically neutral radiations, and quite analogous to X-rays. Their penetrating power is immensely greater than that of either alpha or beta-rays. Since they are not electrically charged, they are unaffected by either electric or magnetic forces.

Even beta-rays may be resolved into many distinct groups which suffer different deflections under the influence of a magnetic field.

Some thirty years ago Aitkin made the discovery that fine dust particles serve as a nuclei for the condensation of moisture and the precipitation of rain. Sudden expansion of saturated air causes a precipitation of a fog if dust particles are present; in their absence it was concluded that the expansion and consequent cooling must be carried much further than are necessary for condensation when dust nuclei are present. But when no cloud was formed in dust-free enclosed air by sudden expansion the heating to redness of a platinum wire in the enclosure was immediately followed by condensation. The scientific men of that day, including Sir Oliver Lodge, whose brilliant experiments in Montreal I well remember, did not imagine that the hot platinum wire gave off anything but dust and invisible smoke. At that period the electron whas not even known, much less its function in ionizing the air and thus furnishing nuclei for the condensation of moisture. It has now been abundantly demonstrated that alpha, beta and gamma-rays all produce ionization of gases, and that these ions in turn condense moisture. Thus a way has been opened to make visible the track of electrons and

alpha particles. Mr. C. T. R. Wilson of England has been most ingenious in devising methods of making visible the trajectories of flying particles and even of photographing them. So now we have lantern slides to bring to the eye evidence of the presence and effects of these smallest known bodies of the physical world, these ultimate corpuscles of matter or electricity, whichever it may be.

The path of an individual alpha particle is shown by the condensation of water on the ions formed in its path, and is seen as a straight luminous trail which was photographed.

A similar effect is produced by beta-particles, but the trail is not so intense and is discontinuous, showing the condensation on individual ions, on account of the higher speed and smaller ionization of the lighter and swifter particles.

The number of ions produced in air at atmospheric pressure depends on the speed of the particles. For alpha particles it varies from 2000 to 6000 per millimeter of path, that is, between 50,000 and 150,000 per inch. The high speed beta particles in general are much less efficient ionizers; they produce not more than 20 or 30 ions per millimeter of path, that is, 500 to 750 per inch. In most cases the number of ions produced is minute compared with the number of molecules present. It is possible to detect the presence of one or two ions in a cubic centimeter per second, while the number of molecules in a cubic centimeter at standard temperature and pressure is 2.7×10^{19}.

Beta-rays you will recall consist of electrons. The electron is often called the "atom of electricity." It is probably the ultimate element out of which all matter is built, or at least, it enters into the structure of every atom of matter. Until recently the atom of hydrogen was supposed to be the smallest existing mass of matter. The atom, as the word signifies, was the ultimate mass indivisible by any known means. But the electron has a mass only 1/1800 as great as the atom of hydrogen, and all electrons are the same, whatever be their source. Thus the old "atom" of chemistry has lost forever its character as the ultimate body into which matter may be resolved. Instead of sixty or seventy elementary atoms, we now have one ultimate electron; even that may be only negative electricity, for its mass is not a constant but varies with its velocity. If its velocity approaches that of light, its mass is nearly trebled as compared with a velocity one-third that of light. Even the constancy of the mass of matter is therefore brought in question by these latest discoveries on the borderland of matter. The change of mass incident to high velocity is too infinitesimal, except in the case of high speed electrons, to affect in any appreciable degree the masses known to astronomy and the ordinary masses of physics and daily life.

The old alchemists sought in vain to transform one element into another. The raison d'etre of their research was the production of gold and not pure science. Their failure has in it a lasting lesson for men of science. Not mere commercialism, but the love of discovery must be the chief stimulus and ruling impulse in scientific work. The marvel now is that in this new century the discovery of the spontaneous transmutation of one element into others in three or four stages has put to shame the fettered imagination and the commercialized search of the alchemists.

The oxide of uranium was discovered in 1789 in the mineral pitchblende, which is now the chief source of radium. It was not until 1840, however, that metallic uranium was reduced from one of its ores. Uranium compounds are now manufactured in large quantities. They impart to glass a rich yellow-green color, which fluoresces in the light of a Geissler tube.

Uranium has the highest atomic weight of any known substance, namely, 238.5 times the atomic weight of hydrogen. It is ordinarily obtained from the mineral uranite, where it is always associated with the other radio-active substances, ionium, radium, and actinium. This association was suggestive of the transformation of an element of high atomic weight into others of successively lower atomic weight. Such has been found to be the case. Uranium is the parent of ionium,and ionium is the parent of radium. Uranium is thus the primary source from which radium is derived, and radium is a disintegration product. Further, radium gives off a gas known as radium emanation, which is also radio-active, that is, it emits alpha, beta and gamma particles. The radium atom disintegrates with the expulsion of an alpha particle, and the residue of the radium atom becomes the atom of the gaseous radium emanation. Now if this gas is sealed in a small spectrum tube and examined with a spectroscope, after a few days the characteristic spectrum lines of helium appear. Thus a known element is produced during the transformation of radio-active matter. The alpha particles expelled from radio-active matter, after losing their positive charge, become atoms of helium. It has been conclusively shown that alpha particles from all types of radio-active matter are identical and consist of helium atoms carrying two positive charges, each equal to the charge on a negative electron. Every radio-active substance, which emits alpha particles during its transformation, gives rise to helium in proportion to its rate of emission of alpha particles. As an example of successive atomic transformation we have the established series, uranium, ionium, radium, helium.

The disintegration of uranium results in the expulsion of eight atoms of helium. The atomic weight of helium is very nearly four, and the eight atoms therefore weight thirty-two. Deducting the thirty-two from the atomic weight of uranium, 238.5, there is left 206.5. This is very nearly the atomic weight of lead, 207. Hence the suggestion that the end product of the disintegration of uranium is lead. The evidence derived from the study of uranium minerals makes it almost certain that lead is the final product of the disintegration of uranium. Much uncertainty remains relative to the end product of other radio-active substances. Atomic explosions result in a loss of alpha, beta and gamma particles, until the excess energy is exhausted and only the end product in each case remains.

The proof that negative electrons exist in all kinds of matter, has given a great impulse to the study of the constitution of the atom. The existence of atoms and molecules has been in no way changed by the discovery of electrons and their properties; but instead of pausing at the atom as the ultimate form of matter, the investigation is now carried further into the constitution of the atom itself.

One of the earliest hypothesis relative to the structure of the chemical elements was that they are built up of hydrogen. The atom has generally been supposed to consist of a number of positively and negatively charged particles held in equilibrium by electrical forces. These particles are no longer conceived to be hydrogen atoms, but the much smaller particles now known as electrons or aggregations of electrons. Thus the present prevailing view is that the atom consists of a sphere of positive electrification surrounded by a number of negative electrons moving around in minute orbits. Sir J. J. Thomson has investigated the several possible stable arrangements, and has found that different groupings differ widely in stability. Some may acquire an extra electron or two and yet remain stable. Others readily lose an electron without disturbance of their stability. The former would correspond to electronegative atoms; the latter to electropositive ones.

Atoms consisting of a number of revolving electrons may radiate energy very slowly, but the continuous drain of energy will finally result in a rearrangement of its constituent parts, or in the expulsion of electrons. This continuous loss of energy, which is known to take place in the case of radioactive bodies, may be the cause of their disintegration.

The great discovery of radiant matter by Crookes has been followed by the complete identification of cathode rays and beta particles from radium and other radio-active substances. They consist of electrons carrying or composed of the negative atom of electricity, and their mass is only 1/1800 that of the hydrogen atom. They are thus the lightest bodies known to science. They are given off by electric force, by light, by heat, and even spontaneously in radio-active bodies.

Further, since the alpha particles from whatever source consist of helium atoms, and helium is widely distributed in the earth, the sun, and in many stars, as shown by the spectroscope, it would appear that helium is one of the more elementary substances from which the heavier atoms are built. It is significant in this connection that the atomic weights of a number of elements differ nearly by four, the atomic weight of helium. The positively charged center of the atom consists in part at least of charged helium and hydrogen, though it is difficult to see how these parts are held together.

Nor is it at present conceivable in what manner the heavier atoms were originally built up from the lighter ones. The process of disintegration does not appear to be reversible. Enough mystery still remains in the constitution of matter to occupy the mind of man in its solution for generations to come. But it is the glory of this age that a great step in advance has been taken.

WASHINGTON ELECTRIC LIGHT AND POWER STATISTICS.

Preliminary figures of the forthcoming quinquennial report on the central electric light and power stations of the state of Washington have been given out by Director W. J. Harris of the Bureau of the Census, Department of Commerce. They were prepared under the supervision of W. M. Steuart, chief statiscian for manufactures.

The statistics relate to the years ending December 31 for 1912 and 1907, and June 30 for 1902, and cover both commercial and municipal electric plants. They do not include electric plants operated by factories, hotels, etc., which consume the current generated, those operated by the Federal government and state institutions, or plants that were idle or in course of construction.

The decreases shown in 1912 as compared with 1907 are due to the fact that the report for electric railways in 1912 includes a number of the important companies that in 1907 were reported as central electric stations. By combining the totals for several of the items of physical equipment for the central electric stations and the electric railways, a more correct idea may be had of the electrical industry in the state, which increased since 1907 as follows: Primary power, from 109,661 horsepower in 1907 to 341,701 horsepower in 1912; the kilowatt capacity of the dynamos, from 94,987 in 1907 to 209,913 in 1912; and the output of stations, from 283,302,190 kw.-hr. in 1907 to 510,822,553 kw.-hr. in 1912.

The figures for central electric stations are given in detail in the accompanying table:

Washington.

	1912.	1907.	1902.	Per cent of increase: 1902-1912.
Number of establishments	70	71	40	75.0
Commercial	60	65	33	81.8
Municipal	10	6	7	42.9
Total income[1]	$3,087,721	$3,410,542	$783,651	294.0
Light, heat, and power	$2,976,297	$3,219,814	$739,743	302.3
All other sources	$111,424	$190,728	$43,908	153.8
Total expenses, including salaries and wages	$2,270,132	$2,388,628	$651,495	248.4
Total number of persons employed	1,078	885	274	293.4
Total horsepower	95,884	67,224	22,894	318.8
Steam and gas engines (including turbines):				
Number	58	54	38	52.6
Horsepower	18,293	10,764	5,553	229.4
Water wheels:				
Number	64	48	41	56.1
Horsepower	77,591	56,118	17,238	350.1
Auxiliary engines:				
Number	[2]	12	10	.....
Horsepower	[2]	342	103	.....
Kw. capacity of dynamos	57,283	66,308	13,679	318.8
Output of stations, kw.-hours	71,414,473	257,785,236	19,722,262	262.1
Estimated number of lamps wired for service:				
Arc	4,729	[3] 6,771	2,977	58.9
Stationary motors served:				
Number	2,279	1,933	295	672.5
H.P. capacity	28,148	29,686	2,780	912.5
All other varieties.	781,244	[3] 624,865	108,443	620.4

[1] Exclusive of $4,422,080 in 1912; $1,182,423 in 1907; and $641,800 in 1902, reported by street and electric railway companies as income from sale of electric current for light or power or from sale of current to other public service corporations.

[2] Not reported separately.

[3] Exclusive of 256 arc and 5677 lamps of other varieties reported by the electric companies as used to light their own properties. Lamps used for such service were included in the number reported for 1912.

IDAHO, NEVADA, UTAH, AND WYOMING ELECTRIC RAILWAY STATISTICS.

Preliminary figures for the forthcoming quinquennial report on the electric railways of the states of Idaho, Nevada, Utah, and Wyoming have been given out by Director W. J. Harris of the Bureau of the Census, Department of Commerce. They were prepared under the supervision of W. M. Steuart, chief statistician for manufactures.

The statistics relate to the years ending December 31 for 1912 and 1907, and June 30 for 1902. The totals include electric light plants operated in connection with electric railways and not separable therefrom, but do not include reports of mixed steam and electric railroads nor railways under construction during the census year which had not begun operations.

The figures as presented for these states show substantial gains for the decade 1902-1912. The operating companies numbered 12 in 1912 as compared with four in 1902. There were 383 miles of track in 1912 as compared with 92 in 1902. The number of persons employed was 1448 in 1912, the figures for 1902 not being available. The revenue passengers carried in 1912 amounted to 46,770,646 as compared with 11,807,841 in 1902. The gross income for 1912 amounted to $3,894,371, the figures for 1902 not being available. The operating expenses in 1912 amounted to $2,097,899, the figures for 1912 also not being available. The horsepower of the power plants was 41,286 in 1912 as compared with 960 in 1902. The output of stations in 1912 amounted to 34,846,894 kw.-hr. as compared with 776,125 in 1902.

The figures are given in detail in the accompanying table:

Idaho, Nevada, Utah and Wyoming.

	1912.	1907.	1902.
Number of companies	13	7	4
Operating	12	6	4
Idaho	3	2	1
Nevada	2	1	.....
Utah	5	3	3
Wyoming	2	.....	.....
Lessor	1	1	.....
Miles of line	308.97	132.79	61.33
Miles of single track	383.29	173.93	92.54
Miles of single track in states [1]	423.49	202.78	92.54
Idaho	129.13	73.09	3.50
Nevada	11.27	7.15	.....
Utah	260.18	122.54	89.04
Wyoming	22.91	.....	.....
Cars, number	529	233	161
Passenger	327	179	152
All other	202	54	9
Electric locomotives	8	3	.....
Persons employed	1,448	918	[2]
Salaried employees	210	120	[2]
Wage earners (average number)	[3] 1,238	798	[2]
Power:			
Horsepower, total	41,286	12,150	960
Steam and gas engines (including turbines)			
Number	7	5	4
Horsepower	26,186	2,550	900
Water wheels:			
Number	11	10	1
Horsepower	15,100	9,600	60
Kw. capacity of dynamos	24,900	8,525	824
Output of stations, kw.-hr	34,846,894	22,204,231	776,125
Current purchased, kw.-hr	45,163,875	[2]	[2]
Passengers carried	54,646,899	28,599,353	14,114,159
Revenue	46,770,646	23,052,455	11,807,841
Transfer	7,108,268	5,243,733	2,306,318
Free	767,985	303,165	[2]
Car mileage (passenger, express, freight, etc.)	8,718,772	5,176,050	3,211,472
Condensed income account of operating companies:			
Gross income	$3,894,371	$2,087,888	[2]
Operating expenses	$2,097,899	$1,287,794	[2]
Gross income less operating expenses	$1,796,472	$800,094	[2]

[1] Including track in state owned by outside companies.

[2] Figures not available.

[3] Number employed Sept. 16, 1912.

PRESERVATION OF POLES AND PILES.

In replacing a burned railroad trestle on the north shore of Great Salt Lake, engineers found that the piles were still perfectly sound after 43 years of service. Looking for the cause, since these were only of local pine and fir, they found that the timbers were impregnated throughout with salt from the lake.

At another point on the lake, 18 in. piles, set 29 years ago, are similarly preserved with salt which has penetrated to their very center. Timbers in the Southern Pacific trestles across Salt Lake, placed in 1902, appear to be as good as on the day when the piles were driven. They have been preserved well above water line by the salt dashed onto them by the waves, a fact apparently anticipated by the engineers who built the trestles.

The first transcontinental telegraph line which was built before the railroad, extended west from Salt Lake City through the prosperous mining camps of Eureka, Austin, and Virginia City. When the railroad was built, the telegraph line was transferred to follow its right of way and the old poles sawed off at the ground. An engineer who recently examined the butts left in the ground in the salt desert near Fish Springs found that, although fifty years had passed since the poles were cut off, the old butts were perfectly sound.

Telephone and electric companies in the Salt Lake valley have used the local salt for preserving poles. When set up, about 75 lb. of salt is placed around the pole on the ground. This method cannot be used, however, when the pole is on or near a lawn, or in any place where vegetation is desired.

It is pointed out that the reason why the waters of Salt Lake act as a strong preservative, as distinguished from ocean waters, is because the lake water is so much saltier, being practically a saturated solution. Preservation with salt is of no use in ocean piling against the attack of teredos and other marine borers.

Experts in the forest service of the U. S. Department of Agriculture, who have been investigating the preservative treatment of timber, offer the suggestion that ties and poles which have been immersed for some time in the waters of the lake should be impervious to decay if the salt is not leached out by the action of the elements. It has been suggested that this can be guarded against, for example, by painting the butt of the pole with a coat of creosote which will keep out the moisture and keep in the salt.

Aluminum carbo-nitrate is an atmospheric nitrogen fixing compound which may be prepared by heating one part of alumina flour with two parts of ground carbon to a temperature of 1080 degrees C. in an atmosphere of nitrogen.

The total railroad mileage in Oregon is 3278 of which 426 is electric road mileage. The electric roads show well in revenues in proportion to their mileage, the 426 miles of electric line having yielded during 1913, $1,643,680.28 in net operating return, after deducting over half a million dollars in taxes, or about twice the return per mile, taken collectively, made by the steam lines.

CONDENSING EQUIPMENT.

BY FRANK R. WHEELER.

(This article discusses the various types of condensers and describes the limitations and advantages of each, the cycle of operation, the auxiliary apparatus required, and styles used.—The Editors.)

One pound of dry steam at 150 lb. pressure expanding adiabatically to one pound pressure will deliver approximately 132,000 ft. lb. of work. If the same quantity is then expanded to 28 in. vacuum it will deliver approximately 117,500 ft. lb. In the first stage it has increased in volume 7.166, and in the second 12.1 times or a total increase of 86 2/3 times its original volume. It is the ability of the steam turbine to handle the large volumes of the lower pressures efficiently, that is responsible for the decided progress that has been made in condenser practice within recent years.

In the days of Haswell's Handbook, a surface condenser problem was easily solved by providing one square foot of cooling surface for 10 lb. of steam to be condensed. As the result of extended experiments by Weighton, J. P. Joule, James Alexander Smith, G. A. Hagemann, Geo. A. Orrok, and several manufacturers specializing in this line, the solution of the problem is now possible on an engineering basis. Vacuum desired; temperature of cooling water; velocity of water through the tubes all affect the cooling surface required. Power requirements of auxiliaries must be capitalized and pumping head may justify a larger surface to reduce friction head and power requirements. Local conditions, quality and quantity of cooling water available determine which of three general types should be used. They are:

Low level jet condenser using short steam connections, in which the water removal pumps operate against the total head corresponding to the vacuum. In this type the steam and injection water are brought in actual contact.

Barometric, a jet condenser, in which the vacuum in the condenser is utilized for part of the pumping head.

Surface condenser in which steam and cooling water are separated by metal walls.

Certain characteristics of each type follow:

The low level jet, placed directly under a turbine is gaining ground on account of simplicity, small maintenance and first cost, and space requirements. In this type, the cooling or injection water is broken up into films or small bodies and the steam to be condensed brought into intimate contact with the water.

In a jet condenser designed on the "counter-current" principle, steam is introduced below the injection supply and the air suction is so arranged that the air must pass through the coldest water, thereby reducing its volume and necessary capacity of air pump.

The condensed steam and warmed injection water is removed from the condenser base, usually by centrifugal pumps which must be efficiently water sealed to prevent their becoming air bound. A centrifugal pump operating under this service (approximately 28 ft. suction head) must be designed to take its supply at velocities about one-half those used in ordinary service.

Where an abundant supply of fresh water suitable for boiler feed is available the jet type demands consideration but its advantages of lower first cost and space requirements must be balanced against greater power requirements, for the water removal pumps are working against a constant suction head corresponding to the vacuum maintained plus the discharge head, while with a surface condenser it is often possible to limit the total water pumping head to condenser and piping friction. The air pump too, requires about double the power of a surface condenser pump, for it must remove the air liberated from both the injection water and the condensed steam.

Due to "Handbook" formula and guarantees made for test conditions, it is often assumed that jet condensers use less cooling water than surface condensers. This could be true under uniform load, but under any other condition a surplus of water must be provided. To illustrate, assume just sufficient injection water provided to condense the steam passing to the condenser under which condition a temperature difference of 5 degrees F. could be maintained between outgoing injection water and temperature corresponding to the vacuum. Assume an increase of load without increase of injection water, then more heat will be, provided than can be absorbed, the water will boil and the vacuum break with all the unpleasantness incidental thereto. It is therefore customary, in practice to operate with 10 degrees temperature head, the same as a surface condenser, and use practically the same quantity of water. Two manufacturers now make the low level type of condensers with the water removal pumps submerged in the condenser base. These pumps with an air pump of the hydraulic entrainment type, are direct connected and driven by a small turbine. This makes an exceptionally compact and efficient rig. The barometric condenser for small units, low vacua and favorable water conditions, is deservedly popular, but the difficulty of keeping the necessary long exhaust lines tight and expense has caused this type to lose the prestige it enjoyed some years ago.

The surface condenser is, in its elementary form, a chamber containing a number of tubes carrying cooling water. Steam vapor carrying air, is admitted to the chamber, the steam condensers forming a partial vacuum which is maintained by the air pump. Each square foot of tube, or cooling surface has a maximum capacity to convey heat from the steam to water, which quality is effected by material; cleanliness of tube surface; temperature and velocity of cooling water and keeping the cooling surface free from envelopes of condensed steam and air. Weighton in his tests brought this latter into prominence providing drain plates to carry off the condensed steam, and it was quickly put into commercial use as a "Dry Tube" condenser, and, as is sometimes the case, its most prominent exponent adapted it on the "cure-all" principle, with results that tended to discredit the real merit of the design. Commercially it finds its use in condensers where the dimensions from top to bottom tube exceed 42 in. It is also necessary to free the tubes of air envelopes left when the steam is condensed. This is done by arranging a decreasing cross-sectional area and maintaining a constant velocity through the condenser. One manufacturer provides a spiral guide, an idea first used by Capt. Wadogaki of the Japanese navy, and another a heart-shaped shell. What seems the best method, however, is to provide differential spacing of the tubes. For ex-

ample, in a three pass condenser having one inch tubes, the upper bank would be spaced 1⅝ in. centers; the middle bank 1½ in. centers; and the lower bank, the standard, or 1⅜ in. centers. This arrangement combined with drain plates is probably the most efficient design obtainable in the American market.

An important detail often overlooked by the buyer and specification writer, is to call for the tubes to be held into tube plates at both ends by screwed ferrules; the ferrules to have liberally proportioned shoulders for the entire circumference of the tube. Tubes will split and corrode and the commercial factor has compelled the setting of the tubes on such close centers that expaned ends necessitate a new tube plate if more than two tubes are lost at the same point. The advantage of a full shoulder is obvious. The shape of the condenser shell varies, but if the steam passages are properly designed, there can be no themodynamic gain in any particular form. A circle encloses the greatest area for its circumference and the cylindrical form is therefore the most used and has the additional advantage of being stronger for a given weight.

Referring particularly to surface condensers, the presence of air has two very objectionable features; first, raising of the total pressure in the condenser; second, insulating the tubes and decreasing their capacity as a heat conductor. Raw, or fresh boiler feed water, that has not been re-evaporated and condensed through the system contains more than four times the entrained air than water in the system; therefore, when a turbine is started, or a fresh boiler cut in on account of peak or overload, we are imposing on the air pump a maximum or overload at just the time when it is most needed, for the resultant drop in vacuum is cumulative and would soon stall a plant not provided with a liberally proportioned air pump. This point is made to impress on engineers the fallacy of buying condensing equipment, where the air pump is undersized, because it is "guaranteed." The guarantee usually reads for a stated capacity per hour, overloads usually come in minutes, and "Guarantees" never condensed a pound of steam. The additional cost of the next stock size pump is money well spent, for given the same temperature and piping, no one maker can make a square foot of cooling surface radiate more heat units than another, notwithstanding some enthusiastic salesmen. The air pump is the heart of the system and deserves consideration as such.

Steam brought in contact with a cooling medium gives up its latent and sensible heat and condenses to water at a temperature corresponding to the vapor pressure in which it is contained. Assume a definite weight of steam condensed in a closed vessel, then the space formally occupied by the steam will be absolutely empty except for the water of condensation, and at zero pressure if it were not for the pressure of the water vapor corresponding to the water temperature, and the pressure of the air admitted with the steam. Since all water contains air, all steam generated from water contains air. This constant accumulation of air in a condenser, if not removed, would soon affect the condenser pressure materially, for by Dalton's Law, the total pressure in the condenser chamber would be the sum of the pressure exerted by the water vapor and air.

It is the function of the air pump to remove the air carried over with the steam and admitted through leaks in the systems. Remembering that a unit weight of air increased in volume approximately 16.2 times when the pressure is reduced from atmosphere to 28½ in. vacuum and that to remove this air it must be compressed back to atmospheric pressure, it is readily appreciated that to do this in one cylinder and maintain tightness involves some care in design. There are three general types of air pump on the market:

Wet vacuum pumps, in which both the condensate and air are removed in one cylinder. The Rotrex, Edwards and Mullan are the best known examples, and for units up to 2000 kw. they make very attractive installations on account of their simplicity and reducing to a minimum the number of auxiliaries on which continuity of operation depends. They have the additional advantage that a split condenser tube or sudden overload carrying considerable quantity of water would have no ill effect on the system. The above types are made suction valveless and with clearances between moving parts sealed by the water of condensation, and they will produce a vacuum under dead end within 0.2 to 0.5 in. of the barometer, the operating limit being usually dependent upon the temperature of the circulating water.

Dry vacuum pumps are made with a minimum of clearance and handle air only, the condensate being removed by an independent pump, usually a centrifugal, motor or steam turbine driven. Dry pumps should always be made with their discharge valves under the cylinder to provide drainage for any entrained moisture, and with flashparts which momentarily connect the two ends of the cylinder at the end of the stroke. This evacuates the clearance space and increases volumetric efficiency. On account of the necessary small clearance the admission of water in any quantity would ruin the pump as has often been demonstrated. This and the excessive size to accommodate the large volumes is responsible for the trend toward the use of the centrifugal or hydraulic entrainment type.

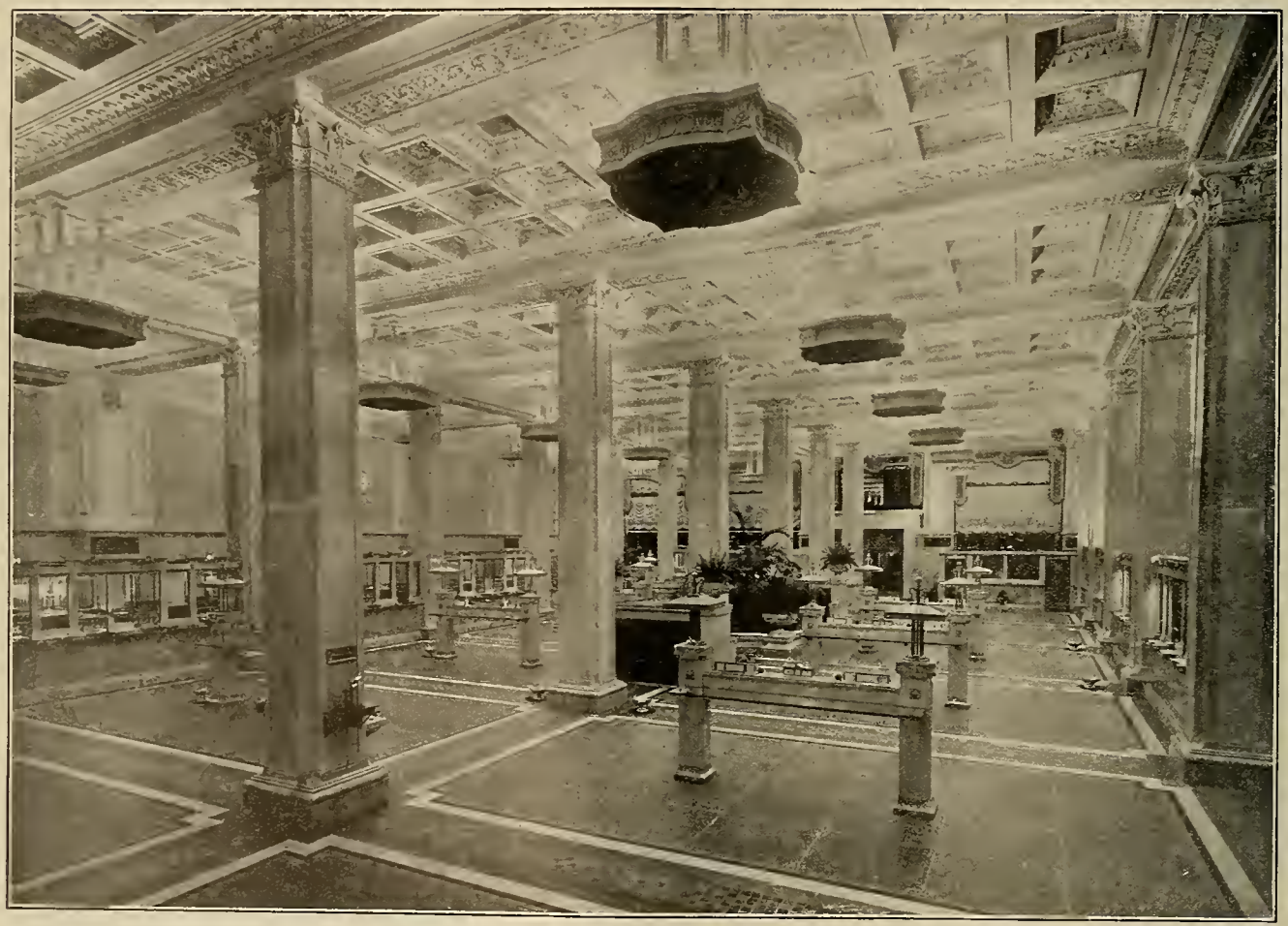
This was developed in Europe and has been quite generally adopted by this country, with the Le Blanc, Thyssen, A. E. G., Kinetic, Ress and Josse as the best known examples. In principle they all depend on ejection action using water as a medium to evacuate the air from condenser chamber. The most efficient type employs a well designed centrifugal impeller to discharge a thin film of water at high velocity. Air is brought into contact with this film and forced through the entrainment rings by the velocity of the water. This type is not dependent upon the vacuum in the condensing chamber for its water supply, as is the case with some of the earlier designs. While the entrainment type of pump uses more power than the positive displacement type, the advantage of great simplicity, space requirements and ability to combine it with circulating or hot well pumps using a single turbine or motor to drive have made it deservably popular, particularly for low level jet condensers. Without doubt, it is the design that will be most generally used in the future, though not because it produces a better vacuum, as some manufacturers would have us believe.

LIGHTING METHODS

BANK LIGHTING INSTALLATION.

The First National Bank, Los Angeles, Cal., is located in the I. N. Van Nuys Building. The building, designed by Messrs. Morgan, Walls & Morgan, is a class "A" structure of the most modern type and of the highest standard. The first three stories are executed in granite and the superstructure in white terra cotta. The site occupied has a frontage on Seventh street of 155 ft. and on Spring of 170 ft.

The bank occupies the entire ground floor, a space, 100 by 170 ft., a large mezzanine floor in the rear, and the entire basement.



Night View of Bank Interior Taken Without the Aid of Flashlight.

The interior design is original and has a distinctive character typical of the work of Messrs. Weary & Alford, of Los Angeles, who designed and furnished the entire decorations and equipment. The lighting system is particularly pleasing and is also unique.

From the inception of indirect systems, especially as applied to bank lighting, these decorators have paid especial attention to the scientific principles involved, which gives this article compiled from data supplied by them, an added value.

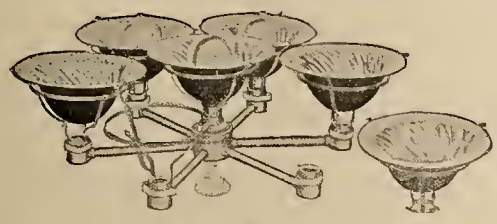
The success or failure of any installation of an indirect system of illumination depends principally upon the reflector and also upon the general color scheme of the room to be illuminated. As a light colored ceiling is the reflecting surface which diffuses the light throughout the interior, the intensity of illumination produced in a room, using a given amount of wattage, depends upon how much light really reaches and is reflected from the ceiling. The way to direct the maximum amount of light to the ceiling is to use the most powerful type of reflector obtainable, and in this instance mirror reflectors have been used exclusively.

A certain fixed intensity of light is necessary for agreeable and efficient illumination, and the problem lies in producing that intensity which will distribute the light on a horizontal plane about 36 in. from the floor. In this particular installation there were a great many different rooms and spaces to be illuminated and the intensities had to be adjusted to suit the requirements of the occupants of the rooms. The illustration shown is a photograph taken in the bank with a 45 minute exposure without the aid of flashlights of any character, and illustrates especially the even distribution of light which has been obtained. Particular attention is called to the clearness in which the tessarae in the mosaic floor have been brought out, as well as certain discolorations in the marble.

The following is a description of the lighting equipment used in this main concourse:

There are twelve outlets in the center bays of the

room and fourteen in the bays at the windows. In each case an intensity of 4.0 ft. candles was figured upon, the room being 128x 92 ft. in size, and 22 ft. from floor to ceiling. In the twelve larger fixtures six 100 watt lamps with the E-100 type reflector were used, and in the 14 other outlets five 100 watt lamps with the same type of reflector, in both instances the top edge of the reflector bowl being placed six feet from the ceiling. These values of foot candles are based upon the 1913 rating of clear bulb Mazda lamps, 25 per cent being allowed for depreciation for dust on lamps and reflectors and the blackening of lamp bulbs due to age.



Constructional Details of Fixtures.

The small illustration shows the type of equipment furnished in any shell which may be designed and great flexibility may be obtained by the use of standard receptacles, holders, bodies, nipples, etc., and by the use of the various types of reflectors obtainable from the manufacturers.

General engineering data for the entire equipment of the first and mezzanine floors will indicate how the type and size of reflector is arrived at after the intensity in foot candles is determined upon, and will prove valuable for reference:

Engineering Data First National Bank, Los Angeles.

Room.	Height of Ceiling. Ft.	Size. Ft.	Area. Sq. Ft.	Foot Candles. Est.	Outlets.	Mazda Lamps per fixture.	Reflector.	To Ceiling. In.
First Floor	12							
Auditor		17x19	323	4.	1	5-100	E-100	30
Stenographer		10x12	120	5.	1	4-60	E-60	36
Cashier		8x11	88	4.5	1	3-60	E-60	36
Women's retiring		11x9	99	2.5	1	2-60	E-60	36
Women's toilet		17x10	170	1.5	1	2-60	E-60	36
Filing		16x18	288	3.5	1	4-100	E-100	30
Directors'		28x17	476	3.5	2	3-100	E-100	30
Director's toilet		11x11	121	2.0	1	1-100	E-100	30
Clearing house		26x18	468	4.5	2	4-100	E-100	30
Court—								
1 bay		16x19	304	3.5	1	4-100	E-100	30
2 bays		28x19	532	3.5	2	4-100	E-100	30
1 bay		19x19	361	3.5	1	4-100	E-100	30
Foot of stairs		17x8	136	2.0	1	2-60	E-60	36
Main Floor—								
Court	22	128x92	11778	4.0	12	6-100	E-100	72
Ceiling				11.	14	5-100	E-100	72
7th St. entrance.		7x14	98	2.0	1	1-100	E-100	36
Mezzanine	9							
Statements		24x12	288	4.0	2	4-60	E-60	24
		19x12	228	4.0	2	3-60	E-60	24
Stationery		17x11	187	2.3	1	3-60	E-60	24
Women's retiring		17x18	305	2.0	1	4-60	E-60	24
S. W. corner		36x18	648	4.0	3	5-60	E-60	24
S. E. corner		48x16	768	4.0	3	6-60	E-60	24
Center		47x22	1034	4.5	6	5-60	E-60	24
Telephone		8x8	64	2.5	1	2-40	E-60	24

ANSWERS TO QUESTIONS.

(These answers submitted by a reader are in reply to the questions submitted in a recent issue. Readers are invited to use this department of Journal service as a forum for the discussion of their lighting problems.—The Editors.)

Mr. F. Laurent Godinez is a well-known Eastern decorator and illuminating engineer and his recommendations made in "The Lighting Book," can undoubtedly be accepted without reservation. It is possible that particular statements may not be fully understood by the layman reader.

I. It is understood that in this case it is desired to place a lattice work over the entire ceiling of the living room, a total ceiling area of approximately 600 sq. ft.

It would not be practicable under any circumstances to illuminate so large an area to a comparatively uniform intensity with two light sources. If subdued by the use of the colored gelatine film, the intensity would be lower and the effect not so spotty to the eye, but would still be impracticable.

On page 108 of The Lighting Book a suggestion is given for the proper lighting treatment of a narrow hall. A diagram is given which is self explanatory and with a low intensity of illumination from below thrown onto the lattice in order to relieve any great contrast betwen it and the light coming from behind, such an arrangement should prove eminently satisfactory to anyone desiring this moonlight effect.

In the problem referred to there is the suggestion that this lighting is to illuminate the room, but blue light is certainly impracticable in a living room and any extreme of any color not to be desired.

I can see no advantage whatever from such a system which with the use of the reading lamps suggested, none of which would throw much light on objects other than those immediately beneath them, would create a gloomy, depressing and undesirable effect.

2. Godinez recommends that in various places throughout the home, Mazda lamps should be reduced in brilliancy by placing gelatine film such as that used in theatres for stage effects, around them.

If required for any particular or special purpose this film can be secured from theatrical supply houses, but unless some such scheme has been laid out as that suggested for an artistic lighting effect in the hall, or for subdued lighting from urns and so forth, there can be no excuse for its use.

3. There are a number of architectural sculptors and modelers in San Francisco who make plaster urns such as that proposed by Godinez, but would suggest that plans for this urn be first prepared by a qualified engineer or fixture manufacturer as it is important that the electrical equipment and construction be given proper consideration. Composition lamp pedestals and lighting fixture bracket arms should be made by a fixture manufacturer. They are never as inexpenvive in the West as is stated by Godinez.

It should be considered that plaster is not exceptionally durable for this purpose Any artistic urn of pottery or even cement, could be properly equipped with a lamp and reflector and would prove more lasting.

The lighting of flowers and foliage in a low urn from below does not appear to be natural or correct. The practicableness of most things is proved by their present popularity and innovations must conform to natural requirements if they are to be permanent and a success.

Regarding the price to be paid for illuminating glassware. It is unfortunate that a book published in the East, should be accepted as verifying Western prices. In addition to freight on Eastern products such as lighting glassware, there is the greater cost of doing business in the West to be added to the price of all things. Any legitimate fixture dealer would secure special types of glassware but it would neither be fair nor reasonable for any person outside that dealer to say at what price the article shall be sold. The desire—the necessity—for business, where competition is as keen as it is in the fixture dealers' business, compel, as a matter of self-preservation or survival, the lowest price consistent with fair profit.

On the whole I would recommend that this home lighting problem be placed in the hands of a duly qualified illuminating engineer or fixture manufacturer with instructions to work in co-operation with the decorator—to the end of securing an effective modern and stay-satisfactory lighting installation.

J. A. S.

WATER POWER LEGISLATION

NEW AND PROPOSED REGULATIONS AFFECTING WATER POWER DEVELOPMENT.

BY L. F. HARZA.

(The author reviews present water power laws and the reasons for their existence in the present form. Touches upon new regulations as evidenced in the latest Forestry manual and the basis of those proposed based upon the report of the last National Conservation Congress. Mr. Harza presented this paper before the Portland, Oregon, Section of the A. I. E. E., February 3rd, 1914.—The Editors.)

It must be evident to all that we are passing through a period of revolutionary changes in laws relating to the use of our natural resources.

Not the least important, by any means, of our natural resources now receiving the attention of political reformers is the undeveloped water power of our rivers and streams. The business of utilizing this resource falls under the head of a public utility enterprise. For this reason water powers are subject not only to a regulation of the terms under which they may be developed, but also to a regulation of the selling price of the output, thus eliminating the law of supply and demand to a degree depending upon the extent to which the doctrine of rate regulation has been applied in the state in question.

Originally it was held by the Federal courts that where property was effected by a public use, the regulation of rates was a matter solely of legislative discretion, not to be interfered with by the courts. (Munn v. Illinois, 94 U. S. 113; Granger Cases, 94 U. S. 155, 164, 179, 180, 181.) Now we see these matters taken entirely out of the legislative branch and entrusted to administrative bodies with subordinate judicial powers.

It has required some time for these regulatory bodies to thoroughly organize and for the establishment of sound precedent relating to disputed points by court reviews of their decisions. I believe I am correct in stating, however, that the gradual evolution of the principles governing physical valuations have tended toward an increasing breadth of view favorable to the operating companies. Certain elements of "present value" under dispute at first are now recognized by the most important decisions as legitimate. Among these may be mentioned: (1) going value, (2) promotion expenses, such as commercial, engineering and financial reports on the proposed undertaking (3) organization expenses, such as expenses of incorporation, legal expenses of passing on titles to real estate, preparing form of bond and other necessary instruments, such as franchises, licenses, etc., (4) promotion profits, (5) engineering, (6) interest, taxes, and legal expenses during construction, (7) brokerage and discount on bonds, and (8) working capital.

It was my intention, however, to merely mention the matter of rate control and to speak especially of new and proposed measures effecting the development of hydroelectric power, upon the assumption that there are at least some present who have been too busily absorbed in their respective duties to follow recent activities in that line. It is not proposed that this paper will contain much, if any, originality, but merely a resume of the present situation.

The question of acquiring title to water rights for power development must be considered under four heads: (a) Intrastate non-navigable streams, on patented or state lands, (b) interstate non-navigable streams, (c) navigable streams, (d) non-navigable streams where the project is in some manner dependent upon lands still in the public domain.

(a) In the case of intrastate non-navigable streams on private or state lands, the jurisdiction of the individual states has not been questioned.

In the humid states of the Mississippi River Valley and eastward the common law doctrine of riparian rights has been almost universally applied. In some states it has always been necessary to secure a special grant from the legislature in each individual case for the construction of a dam for any purpose. This grant usually conveyed explicitly the right of eminent domain for the purchase of overflowed lands, although in some instances, notably in Michigan and New York, this right has seldom been granted.

The doctrine of "Riparian Rights," with which you are doubtless all familiar, is that every proprietor of land on the bank of a river has an equal right to the use of the water which flows in the stream adjacent to his lands, as it was wont to flow, without diminution, pollution or alteration, unless his right has been limited by grant, license or prescription. These rights are considered as inseparably annexed to the soil, and to pass with it, not as an easement or appurtenance, but as a part and parcel of the land, not depending upon appropriation and not suspended or lost by non-use.

The early settlers and miners in the West knew no rules of law. They diverted water from the streams to suit their purposes, and not until the streams were depleted did questions of title to water arise. When called upon to settle disputes some courts were broadminded enough to recognize the doctrine of riparian rights to be utterly unfitted for an irrigation region and to apply the new rule of "first in time, first in right," or the doctrine of appropriation and beneficial use. Other courts tried to adhere to the common law doctrine of riparian rights and to adjust it to meet the new conditions. Conflicting decisions and almost endless litigation has resulted, with the consequence that the ablest lawyers in some Western States admit that they do not know what the law is, and that the only good water title is one gained by prescription or adverse use.

In some cases the cost of litigation has been known to double the cost of development work, and often adds a large percentage. This condition of affairs has placed a great load upon all hydraulic developments in defending themselves against others claiming as both prior appropriators and as riparian owners on the same stream. Under these conditions development can be carried out only in instances where anticipated profits justify the legal hazard involved, or by a large corporation with other and perhaps diversified assets securing the development bonds.

Some Western States, notably Wyoming and Oregon, have set the precedent by instituting a revised water code; eliminating the doctrine of riparian rights and substituting that of priority of appropriation and beneficial use; creating a state board, with subordinate judicial powers, for administering this code, including the investigation, filing and recording of water right applications; the issuance of water right certificates, comparable to a deed of land, upon final proof by the applicant that the water has actually been put to beneficial use; the adjudication of old water rights; and the actual supervision of the distribution of the water according to titles thus granted or adjudicated. The Washington legislature failed to pass a similar code at the last session, but eventually it is to be expected that they, as well as other states, will follow the lead of Wyoming and Oregon in modernizing their water laws.

(b) In the case of interstate streams the uncertainty of water titles is even far greater. This arises from the fact that each state claims jurisdiction over all non-navigable water within its borders. It resulted in the continued appropriation of water from the Arkansas River in Colorado until prior irrigators in the lower State of Kansas, as riparian proprietors, were deprived of their former water supply. The United States Supreme Court refused relief, after protracted litigation, costing the State of Kansas about $200,000, on the grounds that the yet lower State of Oklahoma would then have equal cause for action against both Kansas and Colorado, with evident ruinous effect on all irrigation developments in these states, although implying that when a more substantial injury could be shown Kansas might be entitled to recover. (See Kansas v. Colorado, 206 U. S. 46.)

This case brought out three points: (1) The incompatibility of the doctrine of riparian rights with the necessities of an irrigation region; (2) the injustice of government by injunction, presupposing as it does the existence of the damage, as compared with a system of determining water titles before development and recording them in much the same way as land titles: (3) the need of an interstate or Federal law determining the relative standing of the rights of irrigators in the two or more states of an interstate stream.

Several other cases of this sort have arisen, and yet investors are still at sea as to what rights they can safely defend upon interstate streams. If a state is sole proprietor of its non-navigable waters, then Wyoming, Colorado and other states on the continental divide may divert or store all the water of their streams without reference to prior appropriators in the lower states; and if not, then it is maintained by Mr. John H. Lewis, State Engineer of Oregon, that there should be a national water code applying to interstate streams and administered by a national commission similar to the Oregon State Water Board.

This is not only necessary for irrigation and power development in the Western States, but applies also to the Eastern and Mississippi River Valley States, where extensive storage and other river improvements will undoubtedly be undertaken before many years to relieve the flood menace in that region. The benefit of these improvements will accrue to all of the lower states, to power interests, cities and drainage districts and benefits must be assessed by some form of an interstate administrative commission.

(c) Navigable streams: The jurisdiction of the Federal Government over all improvements on navigable streams to the extent of maintaining their navigability is generally recognized. The ultimate necessity of extending this jurisdiction to include their non-navigable tributaries is only beginning to be recognized. This necessity, to be sure, will be the most felt in irrigation regions where extensive diversions may ultimately complicate the navigation problem.

Two noteworthy papers dealing with the foregoing subject of better water laws have recently been presented before the American Society of Civil Engineers by Mr. H. T. Cory and Mr. John H. Lewis, and have been very widely discussed by the leading hydraulicians. Most of the ideas above stated were gathered from the latter's paper. A reading of these papers cannot but impress one with the urgent demand for water law reform along with that of tariff, currency, trusts, etc.

In conjunction with the presentation of this paper Mr. Lewis submitted a motion to the Society providing for the appointment of a committee to prepare a preliminary draft of a national water law to be applicable to all navigable, interstate and other waters within the jurisdiction of the United States. This committee has been appointed and its personnel insures a very efficient handling of the problem. Their report will be watched with great interest by all.

(d) In the case of developments on non-navigable streams and dependent upon government land two cases must be considered, depending upon whether the required land is in the forest reserves or in the remainder of the public domain.

[To be continued.

LETTERS TO THE EDITOR.

An Author's Correction.

Stanford University, Cal., March 16, 1914.

Referring to my contribution to the discussion of the Taylor paper on "The Electrical Precipitation of Cement Dust," as reported in the March 14, 1914, issue of the Journal: Circumstances required me to send in my remarks by autographic letter. The result is that my writing was misunderstood in one word of importance, start in lieu of "short" as it appears in your printed copy of my letter. This word is used twice in the letter. The corresponding phrases should read "required to start conduction" and "start-of-conduction" in lieu correspondingly of "required to short conduction" and "short-of-conduction."

If entirely convenient and agreeable to you to do so I should be glad to have you call attention to this mis-print in your next issue.

Cordially yours,

(Signed) HARRIS J. RYAN.

Non-corrodable anodes and all metals which do not form insoluble end products of corrosion never cause cracking of concrete as a result of the passage of an electric current.

The fuel consumption of a Diesel engine per brake horsepower hours varies in inverse proportion to the heating value per pound of fuel used, for any given engine and load condition. A fair average is 0.45 lb. with an 18,500 B.t.u. oil, averaging 7.5 lb. per gallon.

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George Westinghouse

On the twelfth day of March, nineteen-fourteen, George Westinghouse, engineer, inventor and manufacturer, passed out at the age of sixty-eight years, honored, alert and active to the end. Nearly fifty years ago he commenced to live the safety-first idea, which developing with the lapse of time has just found expression in the minds of all.

In a description of the use of three thousand feet of pipe for conveying compressed air to the Mount Cenis tunnel boring machinery, he saw the principle of his air-brake, which was later to be universally adopted, though at first ridiculed, and destined to save lives innumerable and to make rapid travel feasible.

Westinghouse desired to avert railway accidents, the disastrous effects of which had appalled him. He saw according to his dominant thought and had the courage and other requisites to a successful issue. He was then not twenty-two.

The development of alternating current machinery was also one of his great achievements; the collosal industries which bear his name are known throughout the world.

Labor can pay its respects to Westinghouse as being responsible for the introduction of the Saturday half-holiday into the United States; an institution which makes for liberty in labor and greater contentment. It is small wonder that he inspired the loyalty of all, and that throughout his long and eventful business career, labor disputes with him were not known.

This brief editorial does not attempt to catalogue all his virtues or achievements. It is a passing tribute to one who, as a product of the great age of industrial achievement, so served mankind that he will live always—in the betterment of things and conditions made possible by the trinity of labor, the work of his head, heart and hands.

The Municipal Lighting Plant

Contrary to the general belief, the growth of municipal lighting plants is not so great as to furnish fear to the advocates of private ownership or to produce pleasure to those who think public ownership preferable. Considering the tremendous growth of the industry, the statistics just published by the Bureau of the Census show that relatively little progress has been made.

But public ownership of the city lighting plant still furnishes the organ upon which the politician strikes a chord of profits to accrue, attuned for ready response in the mind of publics not yet educated to the contrary viewpoint—the greater profits which may result when private corporations instead, are allowed to serve their needs.

Sporadic municipal ownership causing a temporary disruption of the present order is inevitable.

A further cause is that the rate of expansion, due to the inventive spirit fostered by private ownership has been so rapid, that these corporations have, in general, failed to keep the public fully informed as to the remarkable merit of the service rendered, the

reasons for its excellence, the tremendous cost of its perfecting, and the advantage of its continuance.

And because they have not been properly informed, these publics, swayed momentarily by the opposite idea, assume that they can command the earth to stand still that the sun's rays will ever shine beneficently on them.

But to stand still, is to retrograde.

With the removal of private ownership, the main incentive for invention, improvement and progress, it becomes but a question of time before its advantages again become apparent. Municipalities then discontinue their experiment of public ownership.

It is interesting here to note that during the years 1902 to 1907 the number of new municipal plants aggregated four hundred thirty-seven, while from 1907 to 1912 the net increase was only three hundred ten. During this last mentioned period the total capacity of the generating equipment of both municipal and private plants was practically doubled.

Eighty municipal plants were changed from municipal to private operation during that period and seventeen were discontinued, these figures being obtained from the U. S. Census reports.

There has apparently still to be reckoned the hazard of municipal ownership.

In making comparisons between public and privately operated plants it is usual to show the results only in dollars and cents, but of even greater importance, if the public would but appreciate the fact, would be a comparison showing the service secured for each dollar of expenditure.

The privately owned utility sells service, and is always alert for new uses for its product that increased profits may accrue.

It is believed by many that commission control has temporarily altered this condition by making the earnings of utility corporations consequent only upon investment.

In this way the commission has, perhaps unwittingly, pursued obstructionist tactics opposed to the best interests of the public.

It would appear that these commissions must, in self-preservation alone, again permit private corporations to measure their profit by the service rendered.

The incentive to improvement is what constitutes the real difference between public and privately owned utilities. It is not so much the lower rates but the better service rendered which measures the relative value of each.

If all available data were taken into consideration municipalities would almost invariably find, if they wish to try the experiment of public ownership, that it will be to their advantage to first own only their own distribution systems, purchasing the current in bulk from a privately owned corporation.

Should the passing of a reasonable period prove the experience profitable, there will then be ample time to make arrangements, if found desirable, for a complete plant.

It is reasonable though to anticipate a sale of the distribution system to the private corporation. Cities and towns cannot afford to indulge the apathy consequent, for example, upon inefficient lighting. Light is the life of a community and a city is often judged by its brightness.

It needs the enterprise and aggressiveness of private operation, assured a "reasonable" rate of return in order to keep a city abreast the lighting progress made.

Does the saving to each citizen of a few cents on his monthly lighting bill justify the sacrifice of this community good?

Regulation by Competitors

Regulation by the people combined with competition from the same source comes perilously close to making it impossible for other than the people to engage in whatever is profitable business. The risk is too great and capital may be forced either to find other fields or to hide in the long stocking. Such is the effect of too much regulation.

Because of competition from the government parcels post system combined with enforced reductions in rates by the Interstate Commerce Commission, notwithstanding a steady decline in its earnings, the directors of the U. S. Express Company are reported to have voted unanimously to liquidate its affairs and to dissolve in the shortest possible time.

It looks as though the rates forced upon this company must have been based upon assumptions instead of actualities, which has compelled a repudiation of this practice by the business interests at stake.

The paths of public and private ownership have met at the vanishing, or rather, vanquishing point, at which the very basis of business is threatened. Is the reward of success now to result in confiscation or annihilation?

The effect of this action on employes must also be noted. Statistics show continually the remarkable salary increases both as regards the total and the per capita earned, due largely to the past stupendous industrious development and era of business freedom.

As a result of the action forced upon this express company sixteen thousand employes will be temporarily out of employment with the consequent, to them, tremendous loss. The annual payroll of this comparatively small company was over six million dollars.

The conditions necessitating the action taken by the company exist in degree on the Pacific Coast where in several cities, the power which controls or regulates the rates of public utilities is or may be in direct competition, in the form of municipal ownership, with these same public utility corporations.

This is wrong in principle and apparently disastrous in practice. It should be changed.

Let us have either fair and open competition or regulated monopoly, for with even a measure of success or justice, competition regulated by one of the competitors, seems impossible.

One, perhaps satisfactory solution of this problem, would be to have all public utilities including those municipally owned and those private corporations within cities all controlled by the state public service commissions, though these are first cousins german to the public.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

F. B. McAvoy of the Reno Electric Works, Reno, Nevada, is at San Francisco on Business.

W. R. Lyall of the D. & W. Fuse Company, is at Portland, Oregon, and will visit in that city for several days.

Elmer Dover of the H. M. Byllesby Company, has returned to Tacoma, Wash., from his California visit.

Earl G. Wilson, one of the leading electrical contractors of Napa, Cal., was a recent visitor at San Francisco.

J. I. Colwell, local manager of the Western Electric Company, has returned to Seattle from San Francisco.

M. E. Fibush has accepted a position as city salesman with the Brooks Follis Electrical Corporation, San Francisco.

Leroy Nash, salesman for the Pacific States Electric Company, has been transferred to the Oakland house of that company.

C. V. Schneider and A. E. Peck of the Electric Supply Company, Sacramento, Cal., were among the San Francisco visitors this week.

C. E. Wiggin, sales manager electrical department Dunham, Carrigan & Hayden, San Francisco, was at Sacramento during the past week.

E. H. Taylor, of the firm of Pease, Bundy, Taylor Company, electrical engineers and contractors, is at San Francisco from Porterville, Cal.

H. T. Hayes, assistant general manager, Mt. Whitney Power & Electric Company, Visalia, Cal., paid a visit to San Francisco during the past week.

E. E. Gray, representative of the Hotpoint Electric Heating Company, Ontario, California, is in Salt Lake City this week on his regular spring trip.

H. C. Hoover, secretary of the trustees of the Schloss Securities, is at present in England in connection, it is stated, with the refinancing or re-organization of Natomas Consolidated.

B. M. Smarr, until recently, lighting expert in the San Francisco office of the General Electric Company, is now sales manager for the Mohlite Company, with offices at San Francisco.

R. E. Smith, California representative of the National X-Ray Reflector Company, has just returned to San Francisco, having made an extended business trip throughout the state.

John F. Greenwald, of the Mountain States Telephone & Telegraph Company, has been transferred from the public relations department of the company at Helena, Montana, to Salt Lake City.

A. L. Valentine, superintendent of public utilities, Seattle, Wash., will have supervision of the municipal car line to be put into operation either the latter part of March or early in April.

W. S. Cozad, general traffic superintendent of the Mountain States Telephone & Telegraph Company, with headquarters at Denver, is in Salt Lake City going over the company's traffic conditions here in Utah.

J. H. Moseley, formerly with the advertising department of this journal and now with the commercial department of the Pacific Gas & Electric Company, has been hurriedly called East on account of the serious illness of his mother.

Ross Perry has entered the employ of the Capital Electric Company of Salt Lake City as an electric sign specialist, and will devote his entire attention to the enlargement of the sign business of this rapidly expanding concern.

Arthur Walser, district manager of the small motor department of the General Electric Company, has transferred his headquarters from Denver to Salt Lake City on account of the activity in the motor line in the territory served by the Salt Lake City office.

F. J. Mills, business manager, California-Oregon Power Magazine, Yreka, Cal., is spending a few weeks at San Francisco, combining business and pleasure.

C. Masson, illuminating engineer, Southern California Edison Company, Los Angeles, Cal., has been elected a member of the Illuminating Engineering Society.

W. D'A. Ryan, of the General Electric Company, returned to San Francisco during the past week after having made a business trip East on company business and on matters of importance in connection with the lighting of the P.P.I.E.

A. B. Richmond, secretary of the Olston Electric Stove Company of Los Angeles, stopped over in Salt Lake City on his way to Boise, where he has been called on business connected with the opening up of a market for their product in that territory.

C. R. Seigel, division traffic superintendent of the Mountain States Telephone & Telegraph Company, with headquarters at Salt Lake City, has resigned his position and has gone to San Francisco in an effort to improve his health, which has been failing him for the past several months.

Thomas Mirk, of Hunt, Mirk & Co., engineers and contractors, San Francisco, Cal., has returned from a successful business trip to San Diego, made in connection with the new equipment for the San Diego Electric Railroad Company, which company is arranging to build extensions to its system.

Joseph S. Weiis, general manager of the Utah Light & Railway Company, accompanied by L. L. Dagron and O. A. Honnold, engineers of the company, made a trip of inspection last week to Ogden to inspect the company's power dam and pipe line in Ogden Canyon, which has recently been raised, enlarged and repaired.

W. E. Herring, industrial agent, Puget Sound Traction, Light & Power Company, will shortly leave Seattle for the East in order to close negotiations for the location in and about Seattle of a number of new factories. Mr. Herring feels confident that he will return to Seattle with assurances from the factories to this end.

W. L. Huber, consulting engineer, San Francisco, has been retained by the Cuyumaca Water Company of San Diego in connection with the utilization of the waters of Boulder Creek for the generation of electric power. The proposed power plant will be located a short distance below the company's Cuyumaca Reservoir. W. S. Post of San Diego is chief engineer.

Charles M. Schwab, president, Bethlehem Steel Corporation and now at San Francisco, expressed his belief in the future of the Union Iron Works, not only as a repair station on the great maritime highway that will be created with the opening of the Panama Canal, but also on account of the increased amount of shipbuilding that will take place at San Francisco.

George A. Damon, dean of engineering of Throop College of Technology of Pasadena, was the chief speaker at a meeting of the South Pasadena Chamber of Commerce at which he outlined a proposal of combining the Santa Fe, the Salt Lake & the Pacific Electric Railroads from Los Angeles to South Pasadena. It was stated that the plan was indorsed by the roads concerned.

Robert Sibley, professor of mechanical engineering at the University of California and special contributor to this journal, is at the present time recovering from a recent indisposition which although not serious has been sufficient to prevent editing instalments of his series of articles on "Elements of Fuel Oil Practice and Boiler Testing," which accounts for their non-appearance in this issue.

John C. Jones, Statesman for Utah of the Jovian Order, called a meeting on the 11th inst. to arrange the details for a rejuvenation to be held on April 21st concurrently with a general meeting of local representatives of the Utah Power & Light Company which is to be held in Salt Lake City on that date. Statesman Jones has designated a permanent team who are already at work preparing for this event.

OBITUARY.

George Westinghouse, the famous inventor and engineer, died at his New York City residence on Thursday, March 12.



His health had been failing for some time and consequently his death, though a great shock to his thousands of friends and acquaintances all over the country, was nevertheless in a measure anticipated.

The mental alertness and wonderful vitality that had so characterized his brilliant career remained with him to the end.

Although actively associated with a large number of industries, he had during the last few years begun to transfer his responsibilities to the shoulders of his trusted lieutenants, the fortunate selection of which has always been one of the leading characteristics of his varied career.

His demise therefore will not cause any material change in the policy of operation of the companies so indelibly linked with the name Westinghouse.

George Westinghouse was born at Central Bridge, Scholarie County, New York, on the 6th of October, 1846. His father's ancestors came from Germany and settled in Massachusetts and Vermont before the Revolution; the mother's were Dutch-English.

His early school life, military and naval career, and college life, his inventive genius and later achievements are all well known. He was active in the introduction and invention of the air brake which has taken his name, and of train signal systems; while alternating current machinery, the turbine reduction gear, natural gas development and railway equipment, were all utilized by him to contribute to the advancement of the human race. Achievement and service had precedence over all else.

Chance had no place in his success. It has been due entirely to his foresight, courage, and technical skill.

Owing to his many achievements in mechanics, electricity, steam and gas, his name was known the world over, and he had many honorable distinctions conferred upon him for his achievements and in recognition of the services he rendered the various branches of engineering. His alma mater, Union College of Schenectady, conferred upon him the degree of doctor of philosophy. He was decorated with the order of the Legion of Honor, with the order of the Royal Crown of Italy, with the order of Leopold of Belgium. He was the second recipient of the John Fritz medal. He received the degree of doctor of engineering from the Koenigliche Technische Hochschule of Berlin, Germany. He was an honorary member of the American Society of Mechanical Engineers, of which body he was also president in 1910. He was one of the two honorary members of the American Society for the Advancement of Science. He was an honorary member of the National Electric Light Association of America. He was awarded the Scott premium and medal by the Franklin Institute of the State of Pennsylvania. He received the Edison gold medal for meritorious achievements in the alternating current system of electrical distribution. He received the Grashof gold medal from the Society of German Engineers in Germany, which acknowledged him the greatest American engineer.

Mr. Westinghouse was connected with a large number of industries at home and abroad, many of which bore his name. He was president and director of the Westinghouse Air Brake Company, Westinghouse Machine Company, Nernst Lamp Company, The Union Switch & Signal Company, Societe Anonyme Westinghouse, Paris; Cooper Hewitt Electric Company, Pittsburgh Meter Company, Societe Italiene Westinghouse, Italy; The East Pittsburgh Improvement Company, The Westinghouse Brake Company, Ltd., London; Westinghouse, Cooper, Hewitt Company, London; Westinghouse Friction Draft Gear Company, Westinghouse Metal Filament Lamp Company, Ltd., London.

He was also chairman of the board of directors of the Westinghouse Electric Company, Ltd., London, and director Westinghouse Electric & Manufacturing Company, The Traction & Power Securities Company, Westinghouse Metallfaden Gluhlampenfabrik, Vienna.

The Westinghouse Companies employ 50,000 men on whom 150,000 persons are dependent. The total capitalization of all the companies is $200,000,000.

Mr. Westinghouse was married August 8, 1867, at Brooklyn, N. Y., to Marguerite Franklin Walker. They had one son, George, who is a graduate of Yale, and was recently married to the Honorable Evelyn Violet Brocklebank. His wife and son survive him.

MEETING NOTICES.

Seattle Jovian League.

The Seattle Jovians were entertained at dinner Friday, March 13th, at the Butler Hotel by a committee consisting of Messrs. Byrne and Heine of the North Coast Electric Company and Steven Mason. This committee arranged a very enjoyable program and the entertainment presented included a wrestling match, which was contested to a draw by a member representing a jobber and one of the contractors, a four-round boxing contest, by two aspiring light weights, and an elaborate musical program.

Oregon Society, Engineers.

On Thursday evening, March 12th in room "A" of the Public Library Building, Portland, Oregon, Prof.O. F. Stafford of the "Department of Chemistry of the University of Oregon," spoke on the "Fixation of Atmospheric Nitrogen" and illustrated his lecture by lantern slides. This subject proved of great interest to all those present, and should be of interest to all the citizens of Oregon, as well in view of the possible development of electric power at Celilo Falls, on the Columbia River, in such quantities that it may be economically used for this purpose.

Oregon Electrical Contractors' Association.

The regular meeting of the Oregon Electrical Contractors' Association was held at the Portland Commercial Club.

E. F. Dunlap, city inspector of electricity, Portland, Oregon, gave a short talk in which he endeavored to explain to the satisfaction of the contractors the reason why the new electrical ordinance for the city was not ready for final passage. A committee, of which Mr. Dunlap is chairman, has been working on this ordinance for over a year. As the old ordinance is badly in need of revision and the contractors have so long been waiting patiently for the new ordinance they are now investigating the delay, with the idea of getting immediate action.

San Francisco Electrical Development and Jovian League.

At the Hof Brau on Tuesday, March 17, 1914, a large and enthusiastic gathering of the League enjoyed one of the best papers ever presented before that body. The speaker of the day was Wm. Woodhead, president of the Associated Advertising Clubs of America, who spoke on Co-operation in Publicity.

Mr. Woodhead traced the growth of advertising and made many pertinent and interesting remarks regarding its value and efficient utilization. In concluding he directed the attention of members of the electrical industry to the necessity of not only enjoying the benefits to be derived from co-operative effort in advertising, but for each to tie up with it; to gather the cumulative effect and to follow it up with individual effort as "it could not win alone." W. F. Neiman occupied the chair.

The Jovian Electrical League of Southern California.

The weekly luncheon resolved itself into a physical culture class, as, we understand, has been the case with many other Jovian Clubs throughout the country, who have had the good fortune to be addressed by the health lecturer, W. Earl Flynn. The title of Mr. Flynn's address was "High Voltage in Health," and while he held the attention of his audience at high tension, he gave to them many valuable hints on how to remain healthy and gain strength by right living, thinking and eating. Mr. Flynn, who, it is stated, is the highest priced lecturer on any American platform, was introduced in gingery fashion by his staunch supporter and pupil, the Rev. Dr. J. Whitcomb Brougher. Before the close of his address, Mr. Flynn had all the Jovians on their feet, repeating various breathing and muscle building exercises, but in each instance Mr. Flynn, the oldest of them all in years only, surpassed his 100 embryo students by his remarkable feats of endurance. The meeting, which was as interesting and instructive as it was unique, was presided over by E. P. Lewis.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

A joint convention of the above bodies will be held at Spokane, Washington, during September, 1914. It will be the occasion of the Pacific Coast A. I. E. E. Convention and of the seventh annual convention of N. E. L. & P. A.

In view of the joint arrangement and the forceful program which has been prepared, a record attendance is anticipated.

During each morning, parallel sessions will be held—management and public policy papers being considered by the commercial men, and technical topics by the engineers.

Joint sessions will be held during each afternoon so that where both these interests merge, none interested need be absent on account of the presentation of other papers

The necessity for giving the proper amount of time to each subject and of allowing full discussion, the avoidance of a too high convention business peak, and the need for specialization, make such arrangements eminently desirable and should be a marked feature in adding to the success of the convention.

Arrangements are being perfected to hold a monster Jovian rejuvenation at that time at which some of the national officers expect to participate.

In connection with this convention the following committee has been appointed by President Mailloux of the American Institute of Electrical Engineers to in general make all necessary local arrangements in connection with the A. I. E. E. side of the affair:

D. L. Huntington, Chairman, Spokane, Wash.
John B. Fisken, Vice-Chairman, Spokane, Wash.
H. B. Peirce, Secretary, Spokane, Wash.
C. S. MacCalla, Spokane, Wash.
H. A. Shearer, Spokane, Wash.
J. W. Hungate, Spokane, Wash.
S. E. Gates, Spokane, Wash.
E. R. Northmore, Los Angeles, Cal.
C. G. Pyle, Los Angeles, Cal.
G. R. Murphy, San Francisco, Cal.
A. H. Halloran, San Francisco, Cal.
G. P. Nock, Portland, Ore.
R. F. Monges, Portland, Ore.
S. C. Lindsay, Seattle, Wash.
A. A. Miller, Seattle, Wash.
E. M. Breed, Vancouver, B. C.
F. D. Nims, Vancouver, B. C.
Max Hebgen, Butte, Mont.

An excellent entertainment program is being arranged by the officials of the Washington Water Power Company and visitors are assured that there will not be a dull moment during the time the convention is in progress.

Spokane, Washington, September, 1914.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS.

California Section.

C. W. Mitchell, president. W. G. Pennycook, vice-pres.
John W. Carrell, sec-treas.

Address of secretary, 55 Fulton street, San Francisco.

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correllate the answer from the several Inspection Districts as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

The California Section of the National Association of Electrical Inspectors, held its second meeting at the office of the Board of Fire Underwriters of the Pacific Coast, Merchants' Exchange Building, Saturday afternoon, March 14th.

The members present were: C. W. Mitchell, Underwriters' Inspection Bureau; W. G. Pennycook, O. K. Jones, E. F. Henzel, John W. Carroll, Arthur Kempston, Charles Parker, S. G. Curtis, of San Francisco; B. C. Hill, G. M. Hodgkins, H. M. White, F. A. Ellison, of Oakland; W. E. Brothers, Berkeley; W. A. Spencer, San Jose; Jas. I. Dixon, Santa Clara; Fire Chief J. A. Brophy, Vallejo, and W. R. Carpenter, Modesto.

Communications from other cities were received endorsing the new Section and requesting membership application blanks.

By the Secretary.

Ah, my masters, this was a meeting! Not a mutual admiration society, but an organization of fighters with a common enemy in front, and a land of harmonious electrical construction on the horizon. King Chaos was defied, indicted, and in the not distant future will be hurned at the stake to make a common holiday for the electrical fraternity. The chief topic of the meeting was Procedure. The heads of the several Inspection Bureaus represented recited in detail the nature of the ordinance under which they operate, the general standard adopted the method of filing and of recording inspections and the manner of enforcing the law. While the method of procedure in the several localities is somewhat diversified it is manifest that the salient points are very much the same and that a standardization of the common practice is entirely feasible. The entire membership of the section is optimistic on this point.

Of more than passing interest was the relating by Fire Chief Brophy of Vallejo and by others of incidents where fires have been caused by defective wiring.

The next meeting of the section will be held at 2 o'clock Saturday, March 28th, at Room 19, Merchants' Exchange Building, San Francisco.

Utah Electric Club.

The regular weekly luncheon was held at the Commercial Club Thursday, March 12th. Leo Brandenberger presided.

W. S. Cozad, president of the Colorado Electric Club, was present as a guest and extended the greetings of his club to the Utah Electric Club. He told how the Colorado Electric Club had grown so rapidly as to make it necessary to absorb the Traffic Club, which had formerly been the principal commercial club of the city.

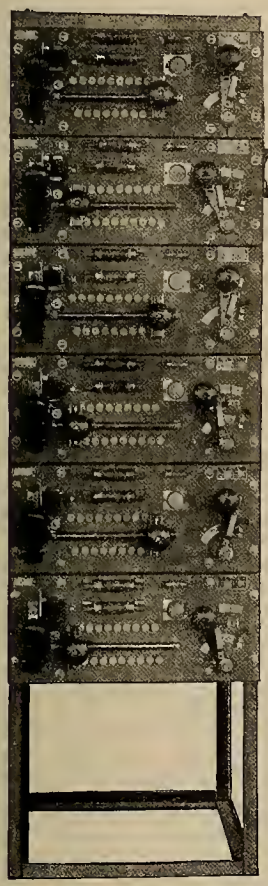
J. F. Greenwald, special representative of the Mountain States Telephone & Telegraph Company, recently transferred here from Helena, Montana, followed with a few well chosen remarks.

John D. Spencer, general agent of the New York Life Insurance Company, who has conducted a regular class in "Salesmanship" at the Y. M. C. A. for the past five years, delivered a talk on this subject as the regular speaker of the day.

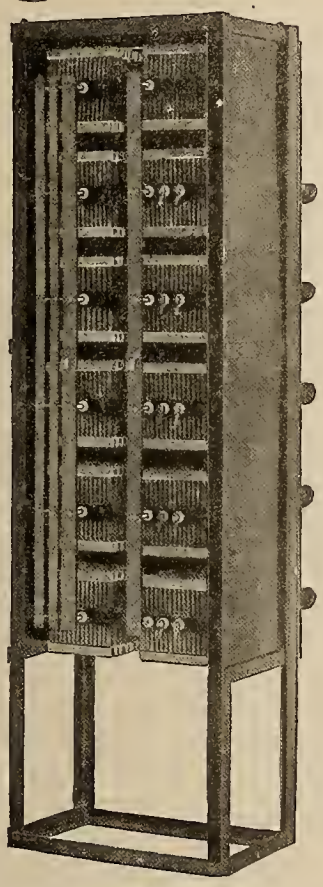
INDUSTRIAL

SECTIONAL BOOK CASE IDEA BATTERY CHARGING PANELS.

Owing to the steady increase in the use of electric passenger and commercial vehicles, charging stations are called upon at frequent intervals to increase the capacity of the charging equipment. Because of this it is advantageous to install equipment to which additions can be made easily and economically. The new Universal unit type charging panels made by The Cutler-Hammer Manufacturing Company of Milwaukee are made up of self-contained rheostats assembled in frames in much the same way that the present day efficient sectional filing cabinets or book cases are assembled, each standard panel accommodating any number of sections up to six. Any number of panels can be assembled side by side according to the space available and regardless of the fact that these may be installed at different times, the complete equipment will have the appearance as if installed at one time. These panels are for use on both two-wire and three-wire circuits.



Sectional Universal Unit Type Battery Charging Panels.



Rear View.

Each charging section is a unit in itself and consists of a slate front 24 in. by 10 in. carrying the rheostat contacts and sliding brush; a low current circuit-breaker, at left side; an instrument switch, at right; a pilot lamp and grid type resistance mounted on the back. On the upper left hand corner of the front a card holder is provided in which a card bearing the designation of the charging circuit can be inserted. Each section is supported by bolts to the frame and after disconnecting from the bus-bar can be readily removed if these bolts are taken out. For repairs or inspection a section can be taken out about as easily as a drawer or section from a filing cabinet.

The low current circuit-breaker mounted at the left of the front is interlocked with the rheostat so that it cannot be closed except when the sliding brush is moved to the position of "all resistance in." It can then be closed and a small magnet which is in series with the charging circuit holds it in this position unless the charging voltage falls to a value less than the battery voltage or in case the service fuses should be blown. It thus acts as a line switch.

The instrument switch is a three-position switch having "Open," "Closed" and "Reading" positions. When in the "Open" position the circuit to the battery is broken; moving to the "Closed" position completes this circuit—and when in the "Reading" position the meter, which may be mounted on the top section or on a swinging bracket, is connected in the battery circuit indicating the voltage of the battery. If the low current circuit-breaker is closed, the current is also indicated on the ammeter scale of the instrument.

The duplex instrument which is furnished combines ammeter and voltmeter and a single instrument can be used for several panels, if desired. The scales are five inches long and thus allow close readings.

A discharge rheostat is mounted on the top section of some panels to operate in conjunction with the charging rheostat section directly below it.

As can be seen by referring to the illustration everything is within easy reach and no operating rods are required. The rheostat being arranged adjacent to the controlling switch, eliminating the chance for error in operating the wrong rheostat. Meter readings are made without opening the charging circuit. The voltage and current may be read at any time by moving the corresponding instrument switch to the "reading" position. It is not intended that more than one of these switches be operated at one time but should anyone through ignorance move two at once, no damage will result, as by a special arrangement of the voltmeter connections, the cross currents resulting are made ineffective. When it is desired to stop the charge, the circuit is opened by moving the instrument switch to the "open" point, the arc formed on opening the circuit being taken on the auxiliary contacts which are provided with magnetic blowout. This opening of the circuit de-energizes the low current circuit breaker which opens, disconnecting the battery from both sides of the line. When the plug is removed from the vehicle, the charging cable is entirely dead.

TRADE NOTES.

Bay Cities Engineering Company, Humboldt Bank Building, San Francisco, has been awarded the contract to furnish and install the overhead equipment of the Union street line, at a cost of $4700.

The Eppstein Electric Company, San Francisco, has been absorbed by the California Electric Construction Company which will conduct this new business from 664 Mission street, the present location of the former concern being closed out.

The West Coast Engineering Company has obtained the contract for the electrical installation in the Crystal Ice & Cold Storage Company's plant, Portland, Ore. This plant is being changed over from steam to electrical drive throughout.

NEWS NOTES

FINANCIAL.

TACOMA, WASH.—For the first full year it has been in operation, the Nisqually power plant of Tacoma shows a profit of $290,000 to the city, according to the report of the state bureau of inspection and supervision of public offices, made public recently. The plant was built at a ost of about $2,000,000 and was put in operation a year and four months ago.

INCORPORATIONS.

BELLINGHAM, WASH.—Articles of incorporation of the Blaine Electric Company have been filed. The capital is $250,000 and the purpose of the company is to build an electric line between Lynden and Blaine.

KLAMATH FALLS, ORE.—Articles of incoporation of the Keno Power Company, capitalized at $250,000 have been filed by J. W., B. E. and G. G. Kerns, and will operate in Klamath Falls if a franchise is granted the company by the city council.

ILLUMINATION.

GOLCONDA, NEV.—The commissioners have granted the application of J. B. Fayant for a franchise to construct and operate an electric light and power plant in this town.

LOS ANGELES, CAL.—The Long Beach Gas Company has made application to the board of supervisors of Orange county for a franchise to lay pipes and supply gas in the town of Seal Beach.

SAN DIEGO, CAL.—The city council has commissioned the installation of 50 additional arc lights to be installed in the residence sections of the city. Work will begin in the near future.

EVERETT, WASH.—Bids will be received until March 24th for the furnishing of lights for the streets and public buildings of this city for the period of either three or five years commencing April 1, 1914.

LOS ANGELES, CAL.—Resolutions urging the council to take steps to acquire a gas as well as an electrical distributing system have been passed by the N. E. W. Commercial-Improvement Association,

PROVO, UTAH.—The Utah Power & Light Company has entered into a contract with Provo City providing for the supply of fifty 6.6 ampere luminous arc lamps for street lighting purposes at $5.50 each per month.

ORANGE, CAL.—Sealed bids will be received up to April 8th by the board of supervisors of Orange county for a franchise granting right to lay, operate and maintain gas distribution system under and along public streets in or near Bay City, Cal.

SAN FRANCISCO, CAL.—An ordinance was passed by the city council prohibiting the placing of advertising signs on telegraph, telephone or electric light poles, lamp posts or upon any public sidewalk or roadway, and excepting street and hospital signs.

SEATTLE, WASH.—The Puget Sound Traction, Light & Power Company has applied for an electric lighting franchise covering a district north of this city, and hearing of the petition is set for March 30th. The city of Seattle has filed its application for an electric lighting franchise covering a district north of the city of Seattle, and a hearing was also set for March 30th.

MOUNT PLEASANT, UTAH.—Mr. A. Lundberg has just completed and placed in operation an electric generating station for the purpose of supplying energy to this town. The plant derives its water from Pleasant Creek through approximately 900 ft. of pipe, using 16, 14 and 12 in. size carrying the water to a Pelton type water wheel which drives a 30 kw. generator. Mr. Lunberg plans to supply, in addition to his own requirements, those of the merchants located in the business part of the city.

TRANSMISSION.

LOS ANGELES, CAL.—Electricity for the Coachella vallew will be available within the near future if the plans of W. F. Holt, who has charge of the project, are completed according to schedule. The distribution system will furnish electricity to every portion of the Coachella valley, the rights of way for which have practically been secured. Mr. Holt was in Los Angeles during the past week negotiating for a right of way for the power line.

DREWSEY, ORE.—It has been announced that John E. Johnson & Sons Construction Engineers, who have been employed in building the Drewsey Reclamation Company ditch have filed on a power site above the Ott sawmill and contemplate the construction of a power plant capable of generating over 4000 h. p. Electric current will be carried to a number of towns in reach. But the main power will go to Harney, where it will be used to pump water from wells for irrigation.

OREGON CITY, ORE.—An electric system to include the towns of Needy, Liberal, Macksburg, Molalla and Wilhoit operated with power from a $25,000 plant on the Molalla River is the plan of M. J. Lee and his associates. Mr. Lee will petition the court for a franchise to construct pole lines on the county roads through that district. Machinery for the power plant through that district. The work of building will be under way within a short time, and it is believed that the system will be in operation in a few months.

RENO, NEV.—Ground has been broken at the Sparks shops for the erection of an electric plant which will cost in the neighborhood of $40,000 and which, when completed, will furnish sufficient current to operate the block signal system of the Salt Lake division from Imlay to Blue Canyon. The building will be 60x40 ft. and will be equipped with the latest modern machinery. With the present system of using batteries, the difficulty of any one of the thousands in use becoming defective, thereby disabling the signal system, is to be done away with and power houses are being erected at two other points along the division to meet the requirements. It is being added to the power house which furnishes the electricity for the shops and offices of the company, the current being supplied by the Reno Light & Power Company.

LOS ANGELES, CAL.—Long litigation is indicated following the decision of city officials to start condemnation proceedings of the power companies properties. It is generally believed that the Southern California Edison Company's system will be the first selected for proceedings. This company has systems in sixty towns in five counties in Southern California. If its property can be taken by the city of Los Angeles it can be acquired in the same manner by any or all the other cities and towns supplied by it, and the company's entire $30,000,000 investment would be affected. As a result, a legal war is inevitable, especially in view of the fact that the city can not readily be separated from the main system. Officials of the Edison Company are stated to have said that it is probable that a suit to prevent condemnation and to challenge the right of the state railroad commission to condemn the system may be carried to the United States supreme court if the city persists in the plan now under consideration.

TRANSPORTATION.

LOS ANGELES, CAL.—Paul Shoup, of the Pacific Electric Railway, has announced definitely, that his company has no intention of extending its lines to San Diego as rumored.

ALAMAGORDO, N. M.—A difference of $26,500 in estimates of value of the right of way between the towns of Hope and Artesia is holding up the conclusion of negotiations for an electric railroad between Cloudcroft and Artesia, is the statement made by J. C. Jones, one of the promoters.

PORTLAND, ORE.—By a vote of four to one the city commission granted a franchise to the Portland Railway, Light & Power Company for a crosstown street car line on the East Side. The franchise provides for the completion of the line within one year and runs for twenty-five years.

LOS ANGELES, CAL.—An agreement has been reached between the city and the Pacific Electric Railway on the construction of the proposed elevated tracks from rear of Sixth street station to San Pedro street. As a result, early action by the board of public utilities and the council in granting the franchise for the elevated tracks is promised.

SAN FRANCISCO, CAL.—Bids for furnishing concrete trolley poles for the Van Ness avenue line of the Municipal Railway have been received by the board of public works, the lowest of the four proposals being filed by H. S. Tittle. The lowest bid for furnishing underground conduit materials for the Municipal road was presented by Pierson, Roeding & Company. The bids have been taken under advisement.

SAN DIEGO, CAL.—The San Diego Railway Company plans to build a loop line by way of B street, Third, F and Twelfth streets, to handle the exposition crowds, and to extend the F street line as far as India street, if the franchise is granted by the city council. Permission to double-track F street will be asked, and to eliminate goose neck curves at Fourth and F streets and at other places where used by the Los Angeles & San Diego Beach Railway in operating downtown cars.

VANCOUVER, B. C.—Disclosure of the fact that five parties of engineers are in the field surveying routes for extensions north and south and branches east and west in connection with the proposed line for the Calgary and Fernie railway line, taken in conjunction with other moves which have lately become known, leads to the belief that one of the big American roads, the Great Northern or the Milwaukee, intends to invade the Canadian Northwest and find a new route to the Pacific Coast.

SAN FRANCISCO, CAL.—The price to be paid for the Union street railway by the city to the Presidio & Ferries Railroad Company, has been fixed at $312,322 by City Engineer O'Shaughnessy and the company's representative, T. C. Mullin. The company received $50,000 of the amount when the agreement to purchase was made, leaving $262,322 due, with an additional allowance of $3483 for interest at 5 per cent for 97 days from December 10, 1913, when the road was taken over for operation by the city.

SEATTLE, WASH.—A loan of $9000 from the general fund to be repaid at such a time as the revenues of the municipal car line are sufficient, is proposed by the city utilities committee to provide money for the establishing of service extending from Pine street to Thirteenth avenue West. The bill will go to the finance committee Friday with the recommendation of the city utilities committee that it do pass. Under present plans the line will be put in operation either the last week of March or the first week of April.

OAKLAND, CAL.—In furtherance of the plans for refinancing and developing the properties of the San Francisco-Oakland Terminal Railways, which have been evolved since the recent acquisition of the traction system of the east bay cities, a stockholders' meeting has been called to consider an increase of $15,000,000 in the bonded indebtedness of the railroad company. Notices have been issued to stockholders announcing a special meeting at the San Francisco-Oakland Terminal Railways offices in the Syndicate building, Oakland, at 10 a. m. April 7th.

SALT LAKE CITY, UTAH—.Announcement has been made at the offices of the Salt Lake & Utah Railroad Company that March 23d has been set for the inauguration of services of the Orem interurban electric line running south from Salt Lake City to Provo, a distance of about forty-five miles. The service to begin on that date will be by gasoline motor car, pending the completion of the installation of the electrical equipment, which will be on or before June 1st. Special celebrations have been planned in the various cities and villages reached by this line.

OAKLAND, CAL.—The San Francisco and Oakland Terminal Railways has made known its plan to establish its permanent office building at Twenty-second and Grove streets. The present depot is to be moved to some convenient spot near by. The ground will then be cleared and work started on the new structure immediately. The building will be a modern 3-story affair, and the entire management of the Key Route and the Oakland service lines will be housed there. The present offices are in the Syndicate building. It is announced that part of the ground floor will be devoted to a station for Key Route passengers.

SAN FRANCISCO, CAL.—After hearing protests from property owners who objected to the proposed extension of the municipal railroad on Second avenue, between Geary and California streets, and also a delegation who were in favor of the line, the board decided Second avenue the proper street for the extension, and so voted. A bill was passed to print directing the board of public works to prepare plans, specifications and contracts, and advertise for bids for furnishing and delivering the necessary material therefore, and constructing the extensions of the municipal street railway system, for which funds were provided in the bond issue authorized August 26, 1913.

TELEPHONE AND TELEGRAPH.

FLORENCE, ARIZ.—The Mountain States Telephone & Telegraph Company, P. C. Gettins, district manager, has informed the Florence Commercial Club of intention to rebuild its plant here within a few months.

LAS VEGAS, NEV.—Mr. Thomas, manager of the Nevada line of the Utah-Idaho-Nevada Telephone Company, states that efforts will be made at once to extend the line between Caliente and Delamar to Alamo and other points in Pahranagat valley.

LOS ANGELES, CAL.—The Pacific Telephone & Telegraph Company will spend $18,700 in immediate future on miscellaneous improvements to its telephone system in this city, according to C. F. Mason, division superintendent. A large amount of cable is to be placed.

OAKLAND, CAL.—Officials of the Pacific Telephone & Telegraph Company have informed the city officials that the compromise tangle is no nearer solution now than it was a week ago, when it was learned that the directors of the existing concern and those of the defunct Home Company were in disagreement. As a result the compromise matter is still hanging fire in the courts. The directors of the two concerns are arguing over the merits and demerits of the compromise offer made the city by officials of the old Home Company. The Pacific officials say that the Home directors were too free with their offer of concessions. The compromise offer was made to do away with the city's suit against the Home company for $100,000 for selling its franchise to the effect that Pacific Company will pay the city 2 per cent of its gross returns if the suit is dropped and if the city will give the existing concern the additional years granted in the Home franchise.

ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page opposite

A-1 American Ever-Ready Co.
Los Angeles; 755 Folsom Street, San Francisco; Seattle.

B-1 Benjamin Electric Manufacturing Co. 11
Rialto Building, San Francisco.

B-2 Berkeley Electric Cooker Co.
1932 Center Street, Berkeley.

B-3 Blake Signal and Manufacturing Co.
680 Howard Street, San Francisco.

B-5 Bridgeport Brass Co. 4
(See Pierson, Roeding & Co.)

C-1 Century Electric Co. 4
614 So. Grand Ave., Los Angeles; Salt Lake City; 56 Natoma Street, San Francisco; Seattle; Spokane.

C-2 Crocker-Wheeler Co. 12
Title Insurance Bldg., Los Angeles; Salt Lake City; First National Bank Bldg., San Francisco; Seattle.

C-3 Cutler-Hammer Manufacturing Co.
579 Howard Street, San Francisco; Morgan Bldg., Portland, Ore.; San Fernando Bldg., Los Angeles.

D-1 D. & W. Fuse Co.
(All Jobbers.)

D-2 Dearborn Drug and Chemical Works 12
355 East Second Street, Los Angeles; 301 Front Street, San Francisco.

E-1 Edison Lamp Works of General Electric Co.
(See General Electric Company.)

E-2 Edison Storage Battery Supply Co. 12
441 Golden Gate Avenue, San Francisco.

E-3 Electric Agencies Co.
247 Minna Street, San Francisco.

E-4 Electric Storage Battery Co.
Pacific Electric Building, Los Angeles; Spalding Building, Portland; 118 New Montgomery Street, San Francisco; Colman Building, Seattle; Pacific Building, Vancouver.

F-1 Fairbanks, Morse & Co.
Los Angeles; Portland; 651 Mission Street, San Francisco; Seattle; Spokane.

F-2 Fort Wayne Electric Works of G. E. Co.
Rialto Building, San Francisco; Colman Building, Seattle.

G-1 General Electric Co. 13-14-15
124 W. Fourth Street, Los Angeles; Worcester Building, Portland; Rialto Building, San Francisco; Colman Building, Seattle; Paulsen Building, Spokane.

H-1 Habirshaw Wire Co.
(See Western Electric Company.)

H-2 Hemingray Glass Co. 5
330 So. L. A. Street, Los Angeles; 345 Oak Street, Portland; 807 Mission Street, San Francisco.

H-3 Hoagland-Hulse Electric Co.
1707 Naud Street, Los Angeles.

H-4 Hunt, Mirk & Co. 6
141 Second Street, San Francisco.

I-1 Indiana Rubber and Insulated Wire Co.
807 Mission Street, San Francisco.

K-1 Kellogg Switchboard and Supply Co.
Aronson Building, San Francisco.

K-2 Keystone Boiler Works.
201 Folsom Street, San Francisco

K-3 Klein & Sons, Mathias. 5
579 Howard Street, San Francisco.

K-4 K-P-F Electric Co.
37 Stevenson Street, San Francisco.

L-1 Leahy Manufacturing Co.
Eighth and Alameda Streets, Los Angeles.

L-2 Locke Insulator Manufacturing Co. 3
(See Pierson, Roeding & Co.)

M-1 Mannesmannrohren-Werke
Rialto Building, San Francisco.

M-2 McGlauflin Manufacturing Co.
Sunnyvale.

M-3 Moore & Co., Charles C.
Van Nuys Building, Los Angeles; Spalding Building, Portland; Kearns Building, Salt Lake City; 40 First Street, San Francisco; Mutual Life Building, Seattle; Santa Rita Hotel Building, Tucson.

M-4 Morse Chain Co.
Monadnock Bldg., San Francisco.

N-1 Nason & Co., R. N.
151 Potrero Avenue, San Francisco.

N-2 National Conduit & Cable Co., The.
Trust and Savings Building, Los Angeles; Rialto Building, San Francisco.

N-3 National Lamp Works of G. E. Co.
(All Jobbers.)

N-4 New York Insulated Wire Co.
629 Howard Street, San Francisco.

N-5 Norris Co., L. A.
Monadnock Building, San Francisco.

O-1 Okonite Co. 16
(All Jobbers.)

P-1 Pacific Electric Manufacturing Co. 4
80 Tehama Street, San Francisco.

P-2 Pacific States Electric Co. 2
526 So. L. A. Street, Los Angeles; 90 Seventh Street, Portland; 526 Thirteenth Street, Oakland; 575 Mission Street, San Francisco; 307 First Ave., So., Seattle.

P-3 Parker Boiler Co.
201 Folsom Street, San Francisco.

P-4 Pelton Water Wheel Co. 5
2219 Harrison Street, San Francisco.

P-5 Pierson, Roeding & Co. 3-5-12
Pacific Electric Building, Los Angeles; Spalding Building, Portland; Rialto Building, San Francisco; Colman Building, Seattle; Pacific Building, Vancouver.

P-7 Pittsburg Piping & Equipment Co. 16
Monadnock Building, San Francisco.

S-1 Schaw-Batcher Company, Pipe Works, The.
211 J Street, Sacramento; 356 Market Street, San Francisco.

S-2 Simonds Machinery Co.
12 Natoma Street, San Francisco.

S-3 Simplex Electric Heating Co. 16
612 Howard Street, San Francisco.

S-4 Southern Pacific Co. 4-12
Flood Building, San Francisco.

S-5 Sprague Electric Works of G. E. Co. 3
Rialto Building, San Francisco; Colman Building, Seattle.

S-6 Standard Underground Cable Co. 4
First National Bank Bldg., San Francisco; Hibernian Bldg., Los Angeles; Yeon Bldg., Portland, Or.; Central Bldg., Seattle, Wash.

S-7 Staples & Pfeiffer.
102 Steuart Street, San Francisco.

T-1 Thomas & Co., R.
(See Western Electric Co.)

V-1 Van Emon Elevator Co.
56 Natoma Street, San Francisco.

W-1 Wagner Electric Manufacturing Co. 4
Rialto Building, San Francisco.

W-2 Western Electric Co.
119 East Seventh Street, Los Angeles; 507 Sixteenth Street, Oakland; 680 Folsom Street, San Francisco; 1518 First Avenue, So., Seattle.

W-3 Westinghouse-Church-Kerr Co.
Pacific Electric Building, Los Angeles; Pacific Building, San Francisco.

W-4 Westinghouse Electric and Manufacturing Co.
50-52 East Broadway, Butte; Van Nuys Building, Los Angeles; Couch Building, Portland; 212 So. W. Temple, Salt Lake City; 165 Second Street, San Francisco; Central Building, Seattle; Paulsen Building, Spokane.

W-5 Westinghouse Machine Co. 6
141 Second Street, San Francisco.

W-6 Westinghouse Lamp Co. 16
(See Westinghouse Electric and Manufacturing Co.)

W-7 Weston Electrical Instrument Co. 3
682 Mission Street, San Francisco.

W-8 Western Pipe & Steel Co.
444 Market Street, San Francisco; 1758 North Broadway, Los Angeles.

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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POWER SITUATION IN OREGON.
BY W. H. CRAWFORD.

DESIRABLE QUALITIES OF ILLUMINATION.
BY G. H. STICKNEY.

A WEIR PROBLEM.
BY BEN D. MOSES.

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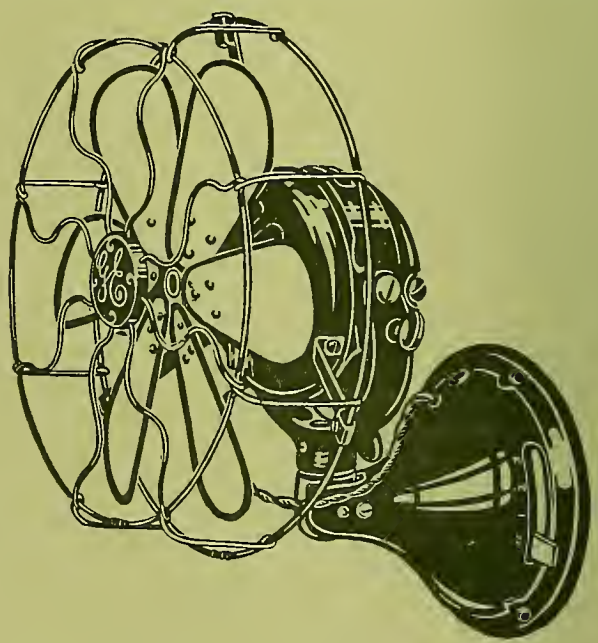
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JOURNAL OF ELECTRICITY
POWER AND GAS
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VOLUME XXXII SAN FRANCISCO, MARCH 28, 1914 NUMBER 13

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POWER SITUATION IN OREGON

BY W. H. CRAWFORD.

(This article details the steam and water power plants of the various companies operating in Oregon and the capacities of each. Describes, in part, the possible and projected water power development and mentions the immense amount of power available for the industrial development of that state. Incidentally, the author refers to an economic condition obtaining in Oregon which favors the installation of steam power plants, notwithstanding the enormous water power possibilities. Mr. Crawford is manager of the Portland office, Chas. C. Moore & Co., Engineers, Inc.—The Editors.)

The great Northwest has always been regarded as a district with wonderful water power possibilities. However, it has lacked the necessary population and the industrial activity to warrant development of these possibilities to a condition of commercial usefulness. That is to anything like what might be expected.

If our great centers of population were only located near the water power or if the water power would manifest itself on the outskirts of our big cities we would have an ideal condition. But fate seems to decree that the people shall live and work in one place and the water sheds have their fall many miles away.

Oregon with an area of 96,700 sq. miles and a population of approximately 750,000 people, forms an interesting study at this time. About one third of the population is located at a single point on the Northern border of the state, Portland, where the Willamette River joins the Columbia. The other two-thirds is scattered principally along the Northern and Western borders of the state, and there are only five centers of population outside of Portland having over ten thousand people. These are the cities of Astoria, Salem, Baker City, Eugene and Medford.

At this writing, taking the state as a whole, there is a great surplus of electric power developed and on the market. This should confirm the supposition stated in the opening paragraph that the Northwest is a district with wonderful water power possibilities, since in spite of a relatively poor market, there has



Celilo Falls on the Columbia River



Station E—Portland Railway, Light & Power Co.

been an over development. In certain parts of the state there may be a shortage due to some local conditions, or to isolation of the district, but in general the over-development is marked. Oregon's position in the power field is ideal to the consumer of power, and the faith of those investors who have brought the product to the market, will surely be rewarded in the near future by a natural and rapid growth in industrial activity that is bound to absorb any over development.

In addition to the developments within the borders of the state high tension power lines have been carried across the state line in many places from outside locations with a wealth of power behind them. These when tied into our own plants make a system of excellent supply.

Beginning with the northern border we find the Pacific Power & Light Company, operating a system of power plants and transmission lines along the Columbia River, that are the biggest possible asset to this promising territory. Within the state they have developed about 2250 kw. near The Dalles and 250 kw. at Hood River, but the big supply comes in over lines from Washington in the neighborhood of Walla Walla. This company does not reach into the Portland territory but passes on down the Columbia to Astoria where they operate a disconnected system. The Astoria situation is of interest because of an arrangement made at that point with the Hammond Lumber Company, whereby the latter supplies current in wholesale quantities to be distributed by the power company. Before this scheme was perfected an old steam plant of 800 kw. capacity was Astoria's supply. When available water power sites were investigated it was found that a cheaper and quicker development was at hand, and this is characteristic of the Oregon field. The Hammond Lumber Mill close by was wasting great quantities of exhaust steam and burning tons of mill refuse in destroyers. It was not difficult to arrange for the installation of two 750 kw. exhaust steam turbines at the lumber mill, and have the latter sell current to the power company. This was accomplished about three years ago, when the old steam plant was placed out of commission and held in reserve. With the growth of the prominent saw mills we find them going over to electric drive. They are not promising customers for the power company since they can cheaply produce their own power, and this also makes them possible competitors.

Thus an arrangement as at Astoria is highly cooperative and profitable, enabling the mill to produce revenue from waste, and saving the power company expense of pole lines outside of the distribution district, right of way costs and maintenance, and any of the other heavy costs of a water power development.

On the southern border of the state the lines of the California-Oregon Power Company reach in from the south and connect with water power plants at Gold Ray 2000 k.v.a. and Prospect 4750 k.v.a. This company also operates an 850 k.v.a. steam and water plant at Klamath Falls.

On the eastern border the Eastern Oregon Light & Power Company have lines extending throughout a district of which Baker and La Grand form a natural center, and have a total generating capacity of about 1500 kw. distributed between Baker, La Grand, Cove, Rock Creek (Haines) and Olive Lake (Sumpter).

The Idaho-Oregon Light & Power Company, has no power development at present in operation within the state although working at Ox Bow on the Snake River at this writing. They import power however into eastern Oregon around Huntington.

The Enterprise Electric Company has about 500 kw. water power divided between Enterprise and Willowa.

Recent competition around Baker has appeared in the shape of the Eagle River Electric Company, with about 750 kw. water power and the city of Baker with 100 kw. developed locally from their water system.

Along the western border of the state we find a few small plants of an independent nature, and a few in the Willamette Valley. There is one good system or chain of plants operated by the Oregon Power Company with a 3000 kw. steam plant at Springfield as the basis. This station is located along side of the big Booth-Kelly lumber mill where an exchange of mill refuse fuel and current is made. This presents a modification of the Astoria situation. At Albany and Dallas the Oregon Lumber Company has additional generating capacity in steam and water to the extent of about 1000 kw. tied into lines from Springfield.

The same company operates a disconnected system at Marshfield on the coast securing current from the biggest lumber mill in the state. This arrangement is again a little different from either Astoria or Springfield in that the C. A. Smith Lumber & Manufacturing Company installed a complete 2500 kw. generating station for the purpose of taking care of their own needs and selling the surplus to the power company for local distribution. The power company then shut down its 500 kw. steam plant at that point, holding same in reserve.

A partial list of the small independent plants in this district may be of interest. Including both coast and Willamette Valley we find approximately:

Small Independent Plants and Capacities Tabulated.

150 kw. in steam power at Tillamook.
275 " " " " Bandon.
100 " " " " Newport.
275 " " " " Bay City.
390 " " " " Seaside.
275 " " " " Newburg (Now P. R. L. & P. Co.)
135 " " " " Cottage Grove.
100 " " " " "Forrest Grove.
225 " " " " Sheridan.
450 " " " " Winchester (Roseburg).
150 " " " " Coquille.
250 " in water power at Canby.
950 " " " " Winchester (Roseburg).
100 " in steam and water at McMinnville.
100 " " " " " Lebanon.

When we turn to the more thickly populated territory around the city of Portland where about one-third of the state's people reside, we find a most interesting situation. In the first place the Portland Railway, Light & Power Company is the old established power company with a system that would be a credit to any community. They have spent money liberally to provide for future requirements as well as present perfection. Their lines reach out into the surrounding country for something like fifty miles in three different directions, and across the Columbia River to the city of Vancouver, Washington.

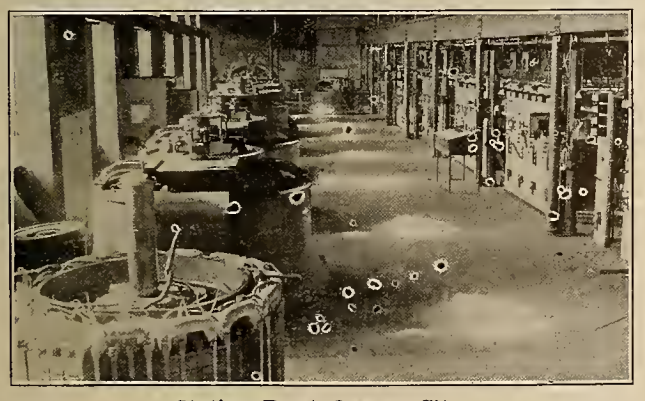
This company has several good water power and steam power plants all tied in together, the best of which are as follows:

Plants of the Portland Railway, Light and Power Company.

Steam Stations—
6000 kw. located near the Inman-Poulsen Lumber Mill, Portland.
2500 kw. " " the Peninsula Lumber Co., St. Johns.
12500 kw. " " the Eastern & Western Lum. Co., Portland.
950 kw. " at Salem, Oregon.

Water Power—
14250 kw. located at Cazadero.
9900 kw. " " River Mill.
7230 kw. " " Oregon City.
10125 kw. " " Bull Run.

The total installed capacity is given as 66,580 kw. In making their developments at River Mill and at Bull Run the Portland Railway, Light & Power Com-



Station B, at Oregon City.

pany also provided for some future extensions so that when the time came to expand they would have only the turbines and generators to purchase. This enables them to enlarge River Mill to the extent of 6600, and Bull Run 3375 kw. at minimum expense and in short time when needed.

One of the biggest demands on the service of the Portland Railway, Light & Power Company is made by the electric railways running out of Portland in every direction. The longest extension so far is that of the Oregon Electric Railway Company to Eugene, 123 miles south. The Portland, Eugene & Eastern is also opening its line to Eugene, and several other links of what will some day be a great system throughout the Willamette Valley.

Regardless of the great abundance of power behind a long distance transmission line it seems from experience that in railway work the lines must not be made too long, or if of any great length, they must be backed up by steam plants at frequent intervals to insure service in cases of emergency. On account of the sawmill feature of the power situation in Oregon, it would seem that in the case of the Willamette Valley development, that one or two combinations similar to Astoria, Marshfield or Springfield would be the natural solution.

A new company has just entered the Portland field, the Northwestern Electric Company. This is another inter-state company. Current is brought from across the Columbia River where a 12,000 kw. development on the White Salmon River was made last year. It is understood that originally the White Salmon project was intended to provide power for the paper mills at Camas, Washington, but it was found to be an expensive undertaking, and not advisable unless carried out to the full extent of its possibilities. Therefore two 6000 kw. units were installed and provision made for about 5000 kw. additional capacity when needed. The power lines were carried down to Camas, and then across the river and into Portland.

To carry out a policy of absolute reliability regardless of expense the Northwestern Electric Company decided early in their campaign to establish a steam plant reserve in Portland. They purchased a block of land on the Willamette River near the geographical center of the city and prepared to build a condensing steam station, of typical design for stand-by service. However since a sub-station would have to be established in the midst of the direct current district to take care of converters and transformers as well as a possible storage battery installation to match up with the service provided by the older company, it was later decided to undertake quite an unusual project.

The condensing plant idea was given up and consideration of storage batteries eliminated by establishing a non-condensing steam plant in the midst of the business district. This plant is to run all the time delivering its exhaust steam into heating mains. The non-condensing steam turbines while running up to speed are not intended to produce current unless there is an interruption to the water power service. They are in a measure big reducing valves, but since they are to be kept warm and in operating condition, they will be just as quick as storage batteries in getting in on the line.

The turbines in reality float on the line with throttle wide open, but governor closed, when not generating, hence at those times steam must be passed into the heating mains by means of automatic valves. Just as soon the turbine begins to generate then it becomes the reducing valve and all steam passes that way.

The heating business in itself holds out great promise at Portland and this combination plant is expected to prove profitable as well as mechanically adapted to local conditions.

The same financial interests that backed the Northwestern Electric Company were at this time putting up a fine big office building in Portland known

as the Pittock block and the basement of this building was modified to receive the steam plant consisting of two 3500 kw. turbines six 500 h.p. Stirling boilers and entire equipment of generating, switching and transformer station.

A substation was located on the block originally purchased for steam plant and with the growth of business in the years to come may eventually embrace a complete condensing plant, although this is not contemplated at present. The Pittock Block is located in a very favorable position for the heating business and the elaborate underground piping system is the best that money could buy.

A new factory district to the north of Portland came into being a few years ago and has had a steady growth ever since. The Monarch Lumber Company promoters located their big mill on the edge of this district and took advantage of their strategic position to add a power business to the mill. Two 750 kw. high pressure turbines were installed to serve the district and had a practical monopoly of the power end as long as the mill operated. Some time ago the mill was forced to close down and the power business was taken over by the Portland Railway, Light & Power Company who supply the service from its transmission lines.

This combination of big saw mills are now utilizing their refuse (that formerly went to waste) by burning it under the boilers at central power stations. The electrical energy generated in excess of their own requirements being sold. Because this economical combination of power plants in conjunction with sawmills is proving so successful, many engineers are quite undecided as to the advantage of the usual water power developments when the central power plant feature can be worked out. Anything that gets away from long pole lines, right of way troubles, and expensive dam or flume construction seems to be a step in the right direction. As noted above we have four striking examples of what can be done on this plan in Oregon, at Springfield, Astoria, Marshfield and North Portland, to say nothing about the steam stations of the Portland Railway, Light & Power Company located adjacent to big sawmills.

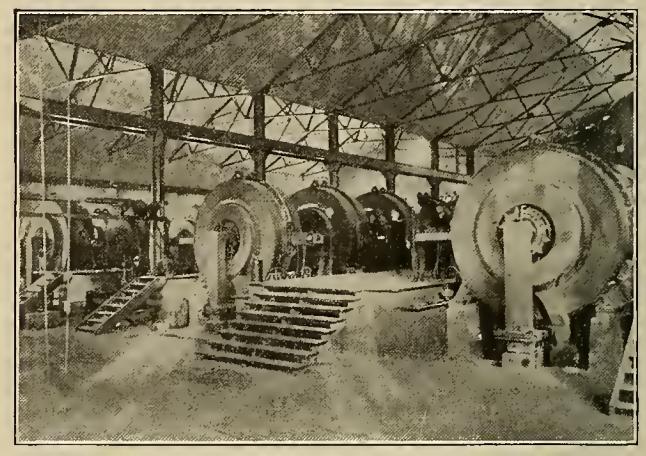
We realize that there are many other instances in the state of similar co-operation but have mentioned only the most striking examples. Also we should add that where a steam plant is not regularly operated, but held in reserve, that mill refuse is not a cheap fuel to handle.

To sum up the situation, Oregon is a wonderful power state. If power were not comparatively easy to develop we would not likely have the great over supply that is now apparent. The Portland district with about one-third the population has perhaps the greatest proportion of this excess development, variously estimated at from ten to twenty thousand kilowatts.

One of the most necessary things to do in any business is to find a market for your product. This is the power problem in Oregon today. The purchaser of current, the manufacturer, the irrigation farmer should all profit by this condition, and as a matter of fact are profiting since new industries are springing up in every direction, and the general good influence of plenty of good cheap light and power is apparent on all sides.

Our cities and towns have a progressive look to them, the electric railway communication is fast and reliable, and in every way is Oregon feeling the indirect results of this present over supply of electric current. The very fact of this condition becoming better known should do much to establish Oregon as a great manufacturing state and a great state in which to live, and in a very short time the demands of the people will absorb I am sure any present over supply of current thus returning to the far-sighted investors the money they have so liberally expended on their faith in the community.

The new developments projected at this time, all of which are more or less dependent on some local condition or allied business consist principally of the Oregon Electric Railway Company's McKenzie River plant near Eugene. A development on the Umpqua River near Reedsport in connection with paper mills proposed for that point. The Santiam Power Company project to take care of paper mills at Lebanon and the surrounding country.



Mammoth Electric Furnaces at Notoden, Norway.

Then we have the collosal Dalles Project at Celilo Falls on the Columbia River, about 200,000 kw. This is a low head development now being investigated by the National government in conjunction with the states of Washington and Oregon for which preliminary work over $30,000 is available. It is the intention to develop this great amount of power cheaply, offering it for sale to attract big industries that require large quantities of cheap electrical energy, such as for electric smelting, nitrate reduction, etc.

This proposed plant would be about eighty miles from Portland but much closer to thousands of acres of land along the Columbia River suitable for industrial purposes and with deep water shipping facilities.

Overhead distribution lines in Britain total nearly one thousand miles in length. They are alternating current ranging between 2000 and 20,000 volts, 115 miles only operating at the highest mentioned voltage. The longest existing direct transmission line is only about 20 miles in length but one of 40 miles is now under construction.

PANAMA CANAL TRANSMISSION LINE WORK

Foundations for the track-span bridges of the high tension transmission lines have been installed between Mount Hope and Diablo, and their installation is now advancing south of Diablo, along the right-of-way of what will be made the permanent main line of the Panama railroad, running into Balboa. At Corozal, their placing required the moving of two crossovers, the shifting of the spur leading to the commissary building, and throwing the temporary track south of Corozal, known as the sand line, to the west, placing it on a center of 19 ft. 6 in. from the southbound main of the Panama railroad. At Gamboa bridge, across the Chagres River, the placing of foundations is delayed by the work of erecting brackets, which are also to support the highway and foot bridge being erected by the Panama railroad on the east side of the bridge.

The erection of the track-span bridges is following closely the completion of foundations. The bridges are in place between Mindi and Pedro Miguel, with the exception of several which cannot be erected at present on account of some local interference.

The one ground-wire and three power wires which are suspended on each side of the track, have been strung between Radio Station and Pedro Miguel, with the exception of the gap at the Chagres River. The insulators are placed at about the same time the bridges are erected.

The steel work for the transformer substation at Gatun has been completed and erection of the walls of hollow concrete block has begun. The steel work at the Miraflores substation is practically completed. Filling for the site of the substation at Cristobal, east at Camp Bierd and opposite the proposed Atlantic entrance coaling plant, is in progress and the Panama railroad is making preparations for driving the piles to support the building. Bed rock beneath this area lies from 35 to 45 ft. below sea level, and the station will be supported on about 600 timber piles. Part of the foundation steel has been delivered at the site, in readiness for the beginning of building operations.

MUNICIPAL ELECTRIC LIGHT AND POWER STATIONS.

Preliminary figures of the forthcoming quinquennial report on the municipal central electric light and power stations of the United States have been given out by Director Harris of the Bureau of the Census, Department of Commerce. They were prepared under the supervision of W. M. Steuart, chief statistician for manufactures. The statistics relate to the years ending December 31 for 1912 and 1907, and June 30 for 1902, and cover municipal electric plants only. Municipal stations are those operated under the ownership of municipalities or other local governments.

As a rule, no cash income is derived by municipal stations for electrical energy used for lighting streets and public buildings, and in order that the income shown may approximate the total consumption and sale of electric current by these stations the schedule required that the income for service of this character should be estimated on the basis of what would have been charged for similar service by commercial companies in near-by localities. The number of persons employed may fall short of the total number actually engaged in work in connection with the operation of the electric stations, because the services of employes for the electrical work often are not required for long or continued service, and they are reported with that branch of municipal work with which they are chiefly employed.

The figures as presented for the United States show substantial gains for the decade 1902-1912. The number of stations increased from 815 in 1902 to 1562 in 1912, or 92 per cent. The total income for 1912 amounted to $23,218,989 as compared with $6,965,105 in 1902, or an increase of 233 per cent. The total expenses for 1912 amounted to $16,917,165 as compared with $5,245,987 in 1902, or an increase of 222 per cent. The total number of persons employed numbered 7940 in 1912 as compared with 3417 in 1902, or an increase of 132 per cent. The plants had a total of 559,328 h.p. in 1912 as compared with 160,028 h.p. in 1902, or an increase of 249 per cent; the capacity of the water wheels having increased from 11,218 h.p. in 1902 to 130,261 h.p. in 1912, or 1061 per cent. The output of stations in 1912 was 537,526,730 kw.-hr. as compared with 195,904,439 kw.-hr. in 1902, or an increase of 174 per cent. The estimated number of arc lamps wired for service was 91,851 in 1912 as compared with 50,795 in 1902, or an increase of 81 per cent. All other varieties of lamps wired for service, however, numbered 7,057,849 in 1912 as compared with 1,577,451 in 1902, or an increase of 347 per cent. There was an increase of 310 stations in 1912 as compared with 1907, accounted for as follows: New stations, 301: From commercial to municipal stations, 106; from municipal to commercial, 80; and 17 stations reported in 1907 that were out of business or not in operation in 1912.

The figures are shown in detail in the accompanying table:

Municipal Light and Power Station Statistics.

	1912.	1907.	1902.	Per cent of increase: 1902-1912.
Number of stations	1,562	1,252	815	91.7
Income	$23,218,989	$14,011,999	$6,965,105	233.4
Electric service, (light, heat and power, including fire service)	$22,663,708	$13,614,434	$6,836,856	231.5
All other sources	$555,281	$397,565	$128,249	333.0
Total expenses, including salaries and wages	$16,917,165	$10,316,620	$5,245,987	222.5
Total number of persons employed	7,940	5,566	3,417	132.4
Total horsepower	559,328	321,351	160,028	249.5
Steam and gas engines (including turbines):				
Number	2,307	1,792	1,078	114.0
Horsepower	429,067	289,500	147,975	190.0
Water wheels:				
Number	269	153	82	328.0
Horsepower	130,261	30,347	11,218	1,061.2
Auxiliary engines:				
Number	(1)	72	36	.....
Horsepower	(1)	1,504	835	.....
Kw. capacity of dynamos	368,677	209,016	113,380	225.2
Output of stations, kw.-hr.	537,526,730	289,462,788	195,904,439	174.4
Estimated number of lamps wired for service:				
Arc	91,851	[2] 82,940	50,795	80.8
All other varieties	7,057,849	[2] 4,061,318	1,577,451	347.4
Stationary motors served:				
H.P. capacity	164,291	31,689	3,324	4,842.6
Number	21,895	4,507	1,962	1,016.0

[1] Not reported separately.

[2] Includes, for purposes of comparison, 595 arc and 28,579 incandescent lamps reported by the electric companies to light their own properties. Lamps used for such service were included in the total number reported in 1912.

LIGHTING METHODS

DESIRABLE QUALITIES OF ILLUMINATION.

BY G. H. STICKNEY.

(In this article the author discusses the limitations attendant upon securing the best possible illumination and the compromises which must be made that the system designed shall be most satisfactory for the purposes desired. Mr. Stickney is assistant sales manager, Edison Lamp Works of General Electric Company, Harrison, N. J.—The Editors.)

To provide suitable artificial illumination for any room or street, or for any purpose, it is necessary to do more than project a quantity of light into space. This seems self-evident, yet there are many installations where apparently little consideration has been given toward achieving the best possible results. Such failures are undoubtedly due to a lack of realization of the desirable qualities of illumination and the manner in which they are produced.

This brings up the natural question: "What are the desirable qualities of illumination?" to which we may give the answer: "For what purpose is it to be used?" In general, there are certain qualities which are desirable for almost any ordinary use; on the other hand, each particular use to which a space may be put, in a degree, modifies the most desirable requirements.

In almost every case the result is obtained by a compromise. For example, we compromise in economy in order to insure a reasonable degree of diffusion. Moreover, the compromise is different in different classes of installations, depending upon the importance assigned to the various qualities. It is obvious that in some cases the demands of economy outweigh those of diffusion; while in others, a good degree of diffusion is of paramount importance. In other words, the test of good illumination is not only the presence of the desirable qualities, but a proportion or balance suited to the particular requirements.

Let us list some of these desirable qualities common to ordinary installations:

(1) Intensity, (2) diffusion, (3) direction of the light, (4) distribution, (5) color of light, (6) its steadiness, (7) reliability, or continuity of service, and (8) economy.

You will note that these qualities are those of illumination, and do not include the important characteristics of lamps and equipments, though they are often the determining consideration in selecting the system of lighting. Such questions, for example, as the convenience of maintaining lamps, do not come within the province of this article.

Intensity.

Intensity is placed at the head of the list. It is the quantitative element and, all else being equal, is the measure of the cost. While it is the most important single consideration, it must be remembered that good illumination is not determined by intensity alone.

In artificial lighting the values run much lower than they ordinarily do in daylight. Our eyes can adjust themselves to a wide range of intensities, so that we have a tendency to economize in the cost of lighting by approximating the lowest intensity permissible. With the intensities ordinarily employed in artificial illumination, we find that we can see detail better and more quickly with higher intensities than with low. Here is where we begin to compromise. If we can sacrifice detail and do not need to see quickly, we can get along with a relatively low intensity of illumination. In manufacturing, however, the increased speed and sureness of the workman obtained with higher intensity, makes the cheaper, low intensity illumination extremely extravagant.

How shall we determine when the relation between the cost and intensity shows the best results? In general, we have to depend upon the practice of today. For example, dry goods stores in a large city use five to eight foot-candles on their main floor sales rooms, with lower intensities (falling to about three foot-candles) on upper floors. This will serve as a guide for other stores, who must use light in corresponding proportion to their requirements.

In manufacturing, where the commercial element does not enter, we may use general practice as a guide or we may make a study of the particular requirements of certain processes. Probably the most extensive intelligent effort to study the intensity requirements of manufacturing processes are those made by the steel manufacturers. They ran a long series of experiments for each of their processes, to determine the minimum and most advantageous intensities of illumination. Changes were made in the working illumination and the results noted. When critical points were determined the illumination was measured and the practice standardized. (See Proc. Iron & Steel Electrical Engineers, Fifth Annual Convention, New York, Sept., 1911.)

Diffusion.

Much is now being said and written regarding the deleterious effects of glare. These have become more and more serious with the development of high efficiency units, with their correspondingly higher intrinsic brilliancy.

In all of our practical light sources, the illumination proceeds from a relatively small point or line which is of such brilliancy as to produce an unpleasant, or even injurious blinding effect if we look directly at the unshielded source. Our eyebrows ordinarily protect the eyes from glaring sources located high above the head; as, for example, the noon-day sun, but glaring lights on or below the line of vision are particularly disagreeable. The glare not only prevents our seeing other objects, but may produce actual injury to the delicate apparatus of the eye.

The construction of our buildings, as well as the dictates of economy, usually require illuminants to be hung rather low. In such a case it is desirable to reduce the brilliance of the light by means of diffusing globes, shades or reflectors which apparently enlarge the light source, making it more agreeable to the eye.

Diffusion, however, contributes a further aid to seeing. Light proceeding from a point or line, cuts sharp, distinct shadows when intercepted by objects, so that harsh contrasts are likely to appear in the illumination. Diffusion, by introducing cross rays of light, produces what artists call transparent shadows, with pleasantly grades fringes.

On the other hand, we do not want to go to the other extreme and entirely eliminate the shadows, which are really very useful in bringing out the contour and shape of objects. This over-diffusion, or flat illumination, is trying to the eyes and very unpleasant.

Diffusion is almost invariably obtained at a loss of economy, since some light is absorbed by the diffusing surfaces. The practice is, therefore, more inclined to lean toward glare than over-diffusion. Dull-surfaced, light-colored walls and reflectors, as well as translucent shades and globes, are principal contributors to diffusion and should be judiciously utilized. The use of sand-blasted or frosted glass or rough reflecting surfaces should be avoided in places where oil and dust are likely to accumulate. The rough surfaces not only form lodging places for light absorbing material, but also are harder to clean than smooth surfaces.

Direction.

It seems to be a perfectly simple proposition that the light should fall upon the objects to be seen, and not directly on the eye. And yet, how many installations are made without considering this point.

The worst and most obvious faults are observed in window lighting, where it is such an easy matter to conceal the lamps and direct the light upon the merchandise to be shown. In some cases, of course, windows are lighted to attract attention rather than to show goods, but in general an attractive display of merchandise is the object of window lighting.

In ordinary installations it is generally impracticable and undesirable to conceal the light sources. But much can be done by locating the sources and directing the light to produce a desirable effect. It is generally advantageous to have the lamps high and out of the line of vision. Lamps can be equipped with reflectors to direct the light downward to the working plane. But cutting off, or diffusing the light through angles near the horizontal, the glaring light can be kept out of the eyes.

Very often rooms have natural illumination centers, from which the illumination can be most conveniently distributed. In a store, while general illumination is required on all surface, the shelves and counters require the most particular illumination.

In manufacturing, familiarity with the process is necessary to tell where the light is most particularly required. For example, with a lathe the principal illumination is required at the tool point, and, to prevent shadowing, it should come from the front and, if possible, the right. In almost all cases the light should come from above.

Distribution.

There are two extremes of practice in regard to the distribution of light, which are known as general illumination and local or localized illumination.

With general illumination an attempt is made to provide a relatively even intensity of light throughout a room, irrespective of the location of machines, counters or furniture. With localized illumination, a light is provided just at important points, falling off to low values in the intermediate spaces. General illmination stimulates daylight, produces the best appearance, and is independent of changes in arrangement of tools, etc. Local illumination usually requires less light flux, especially if work is scattered. It permits the illumination to be adjusted to most special requirements.

When carbon incandescent and arc lamps were the principal sources of illumination, the line between general and local illumination was quite distinct. Since the Mazda lamp has provided an efficient unit with a wide range of available capacities, it has been possible to provide illumination having the most desirable features of both. For example, a relatively even illumination can be provided, with the lamps so arranged as to give a slightly higher intensity at the most important points.

When it is necessary to see up under a low machine or in a deep boring, a small portable lamp is still required. In a high crane bay, the best effect can be obtained with large units or groups of units hung high. In the majority of cases, however, the moderate sized unit gives the best effect. When too small a unit is selected, too large a number have to be used, thus increasing the cost of fixtures and wiring, as well as lamp maintenance. Moreover, in extreme cases, the appearance of such an installation is very poor. On the other hand, if too large a unit is selected, it is not possible to obtain a sufficiently even distribution of light, or the light cannot penetrate around obstacles, so as to avoid excessive shadows. Very often in industrial lighting, it becomes necessary to use smaller units in order to avoid shadows from high machinery.

(To be continued.)

The average peak lighting and power load at the Panama-Pacific Exposition is estimated at 8500 kw.

The formation of an oxidizable nitrogen by the combined action of a so-called "silent" discharge and a "spark" discharge in air at atmospheric pressure was shown in a series of photographs presented by Dr. T. Martin Lowry at the November meeting of the Faraday Society. The Electrical Review (London, Eng.) reports that the observations arose out of experiments made with gases for bleaching flour. The new allotropic variety of nitrogen has the property of being oxidized by ozone to nitrogen peroxide. If no ozone is present the gas quickly reverts to the ordinary form. The existence of this allotropic nitrogen may have some bearing on the technical fixation of nitrogen, and it is suggested that the oxidizable variety is first formed by the discharge and afterwards oxidized by means of the ozone formed simultaneously to the oxides of nitrogen. The chemically active variety of nitrogen recently discovered by Strutt under certain conditions of vacuum discharge would appear to be different to Dr. Lowry's variety, as it is not oxidizable by ozone.

A WEIR PROBLEM.

BY BEN D. MOSES.

It is required to design a dam, or weir, to carry 200,000 sec. ft. of water and the maximum head over the crest is not to be greater than 15 ft.

The ordinary weir formulas which are based on the fundamental expression $Q = cbh^{3/2}$, where c is a coefficient determined by experiment, b is the length of the weir in feet and h is the head on the weir in feet, are unsatisfactory for the reason that the coefficient varies between rather wide limits and because it has been determined for only a limited range.

Bazin, Francis and Feeley and Stearns pioneered the work, and acting on their results Mr. G. A. Rafter obtaining the co-operation of the U. S. Board of Engi-



Cornell Hydraulic Laboratory Where Weir Experiments Were Conducted.

neers on Deep Waterways, and the use of the Hydraulics Laboratory of Cornell University, ran a series of tests duplicating the Bazin Series' Sections as nearly as possible. For details, tabulated results and curves of these, the reader is referred to Trans. A. S. C. E. Vol. 44, and U. S. G. S., W. S. and I Paper, No. 200.

All of the above experiments were performed on a weir of about 6.5 ft. length, and for heads ranging between .1 and 6.0 ft. and the coefficients can be used, with confidence, within these limits—the extended use, however, is more or less doubtful.

Prof. J. N. LeConte suggested, in his article "Flow Over Model of Sunol Dam," Engineering Record, Aug. 16, 1913, that the use of formulas might be discarded and the flow computed by actually calibrating a model of the dam in question. Or, he contends, if a model be made such that all the linear dimensions are proportional and are 1/n that of the corresponding linear dimensions of the actual dam, then the quantity over the actual dam will be $n^{5/2} \times$ that over the model, or $Q = n^{5/2}q$. This takes it that the coefficient c is the same for all similar dams or weirs, all of whose linear dimensions are proportional, or expressing it in symbols,

$q = cbh^{3/2}$ for the small weir or model.

$Q = cBH^{3/2}$ for the actual weir or dam.

but if $B = nb$ and $H = nh$

then, $Q = c\,(bn)\,(nh)^{3/2} = cbh^{3/2}n^{5/2}$

or, $Q = qn^{5/2}$.

Before attempting the direct application of the above principle, let us examine its precision when applied to an actual model. For this purpose I have chosen the section and data found in the Cornell Series of Experiments on the Croton Dam, W. S. and I. paper No. 200, p. 91 and 95. (See Table 1.)

In each case the lowest obtained head (h) is used as a unit and the discharge considered as that of a model one foot long with this head over its crest. The heads (H) considered then in each case determines the factor n as $\frac{H}{h}$, and the length results as $\frac{H}{h}$ feet, the quantity will be $\frac{H}{h} \times$ the tabulated experimental quantity this is then compared with the quantity as found by $q \times \left(\frac{H}{h}\right)^{5/2}$.

It is interesting to note that the error with two exceptions is less than 2½ per cent and with three exceptions less than 2 per cent. These errors come rather consistently on points that, if compared with the curves on p. 95 W. S. & I 200 will be found to be also slightly in error. Possibly if a quantity head curve had been accurately plotted for each model this error would have been diminished. Various authorities on the subject of weirs consider the experiment as being within 2 per cent of being correct.

Now for the extension of the principle.

Fig. 1 shows seven different sections, their corresponding coefficient head, and quantity head curves, as taken from the Cornell Series of experiments. (Trans. A. S. C. E. Vol. 44. pp. 267 to 281) and W. S. & I. No. 200, p. 88.) The limiting head obtainable in each case was, however, less than 6 ft. and the length 6.58 ft.

The curves were plotted carefully and passed through the points accurately, and assuming that the curve becomes a straight line from 6 ft. on the quantity per foot was obtained at a head of 15 ft. for each section, call it q′ then the length necessary to carry 200,000 sec. ft. would be $200{,}000 \div q' = 1$. The section No. 1 and No. 2 give the greatest q′ or least L. $q' = 194$ sec. ft. $— h = 15$ ft., $L = 1032$ ft. This assumes a constant coefficient from 6 ft. on up which may or may not be true.

Now consider the problem from the other point of view (see Table 2). The columns headed h and Q per ft. are taken directly from the experiment as tabulated; the column H is the head over the proposed dam or 15 ft.; the column Ratio n is obtained by considering the 1 ft. model with its head h and en-

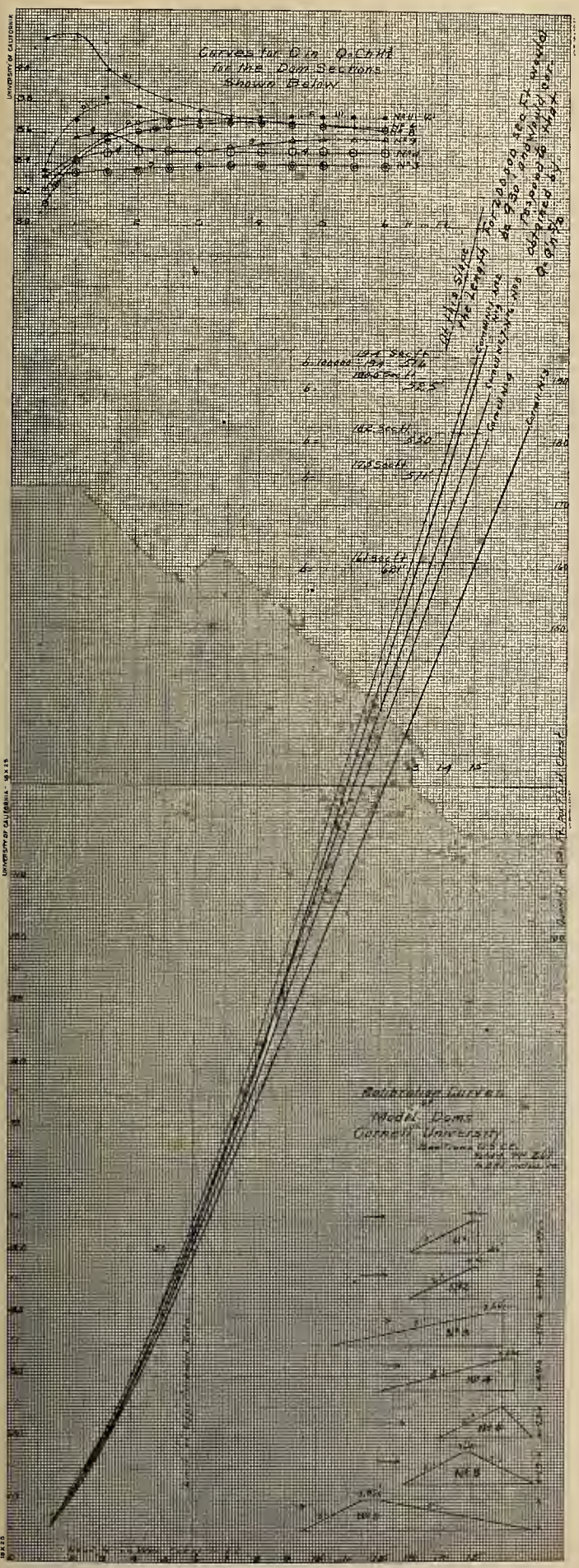


Fig. 1.
Comparison of Different Water Power Fees Charged by the Departments Having Jurisdiction.

$\frac{H}{h}$

larging it n times or — times; it also is the length of the model; the column headed Q shows the quantity flowing over the model nh feet deep and n feet long, and is found by $Q = qn^{5/2}$; and finally the last column is the length of the proposed dam to carry 200,000 sec. ft. 15 ft. high.

Computations for the Quantity Over a Model Dam by the Proportional Method vs. Direct Experiment.

TABLE 1.

	Head taken as Unit q.	Corrected Head on Weir h.	n—H/h.	Tabulated 5/2 Q per 1 ft. Discharge n— Crest 2	for charge. H.	Experimental. Q=qxn— 5/2	Computed Discharge Q=qxn— 5/2	Error Per Cent.
h =	.5907	2.7668	4.683	47.46	14.672	69.2	68.8	—0.58
		2.2116	3,744	27,12	10.562	39.6	39.4	—0.51
q =	1.451	1.4475	2.450	9.39	5.604	13.71	13.52	—1.3
		.9861	1.665	3.57	3.222	5.36	5.19	—1.3
h =	.6305	2.1046	3.337	20.34	9.578	31.91	30.40	—1.6
		1.8395	2.917	14.53	7.883	23.00	21.75	—5.4
q =	1.494	1.5946	2,529	10.17	6.284	15.90	15.20	—4.4
		1.2596	1.997	5.636	4.287	8.56	8.42	—1.6
		.9947	1.577	3.123	3.030	4.78	4.67	—2.3
h =	.4877	2.9753	6.100	91.90	16.475	100.40	99.90	—0.5
		2.9091	5.964	86.80	15.969	95.20	94.40	—0.84
q =	1.087	2.5305	5.188	61.31	12.933	67.10	66,60	—0.75
		2.1661	4.441	41.56	10.211	45.40	45.20	—0.44
		1.6358	3.354	20.60	6.740	22.60	22.40	—0.91
		1.2657	2.596	10.86	4.548	11.80	11.80	—0.00
		1.1465	2.351	8.475	3.913	9.21	9.22	—0.10
		.7309	1.478	2.650	1.945	2.874	2.88	—0.20
		.4877			1.087			
h =	.4251	2.0187	4.748	49.10	9.037	42.85	42.20	—1.50
		1.4129	3.323	20.13	5.308	17.65	17.32	—1.8
q =	.861	.8656	2.036	5.915	2.527	5.145	5.09	—1.07
		.4251						

TABLE 2.

h.	Q per ft. of Model Crest.	H on Proposed Dam.	Ratio m = H/h	5/2 m × q Over Unit length = Q over Model Crest.	Enlarged Model	Length at Dam L.
1.0	3.44	15	15.00	871.0 × 3.44 =	3000	1000
1.5	6.59	15	10.00	316.0 × 6.59 =	2081	960
2.0	10.66	15	7.50	154.0 × 10.66 =	1641	914
2.5	14.59	15	6.00	88.2 × 14.59 =	1286	934
3.0	19.13	15	5.00	55.9 × 19.13 =	1070	934
3.5	24.25	15	4.29	38.0 × 24.25 =	923	930
4.0	29.68	15	3.75	27.2 × 29.68 =	807	929
4.5	35.40	15	3 33	20.28 × 35.40 =	719	929
5.0	41.46	15	3.00	15.59 × 41.46 =	646	930
5.5	47.85	15	2.725	12.30 × 47.85 =	588	928
6.0	54.54	15	2.50	9.80 × 54.54 =	535	934

The average for all, excepting the first three is 931, and the greatest variation is about .3 per cent. The coefficient curve (Fig. 1.) shows also an inconsistency for these points.

Now this is 1032 — 931 = 101 ft. shorter dam than is obtained by extending the curves. (Fig. 1.)

The heavy broken line on Fig. 1 shows where the curve must go to obtain this last result, and which position could be easily and quite reasonably obtained by slightly curving the extend curves.

The use of the telephone in China is limited, though the Chinese take to the telephone with extraordinary readiness. Modern interurban communication by telephone is almost unknown, the only exception being the line between Peking and Tientsin and several small lines used in connection with the dispatch of railway trains. Local telephone exchange systems are found only in Peking, Tientsin, Shanghai and Canton. They are government owned and are operated as a part of the telegraph system. The number of subscribers is not available, but the exhanges are small.

WATER POWER LEGISLATION

NEW AND PROPOSED REGULATIONS AFECTING WATER POWER DEVELOPMENT.

BY L. F. HARZA.

[Concluded.]

The individual states have always claimed, through state charter provisions, the jurisdiction over non-navigable streams. The Department of Agriculture, however, through ownership of the forest reserves, is able to, and does dictate terms to control power development on the reserves. The result is that anyone wanting to build must conform to two sets of regulations, paying filing fees and annual fees to both the state and Federal government. The form of Federal permit which has heretofore been issued has had a life of fifty years, but has been revocable at the discretion of the Secretary of Agriculture, without provision for compensation. The Congressional act which conferred upon the Secretaries the power to grant permits explicitly required that all such permits should be so revocable.

The new "National Forest Manual," under date of February 24, 1913, however, indicates that this authority, although expressly granted to the Secretary by Congress, has now been modified by him in such manner that revocation will be made only upon failure of permittee to comply with the terms of the permit.

In the case of water power rights on the public domain, outside of the forest reserves the Secretary of the Interior has jurisdiction. Since the wholesale withdrawal from entry, a few years ago, of public lands controling power sites, no definite policy has ever been decided upon for their disposal, unless the recent permit issued jointly by the Secretary of the Interior and the Secretary of Agriculture, in the case of the International Power and Manufacturing Company, on the Pend d'Oreille River, may be considered as establishing a precedent to be followed in the future, by the Department of the Interior, if not also as initiating a change of policy by the Department of Agriculture.

A comparison of the fees established by this permit with those of the Forest Service may be of interest to some present. I will assume for the purposes of illustration a power site offering a net fall of 125 ft. and a "nominal" flow of 1000 sec. ft. of water as defined by the "Manual" to be the "flow determined by averaging the values estimated for the natural mean flow for the two-month minimum flow period in each successive five-year period or major fraction thereof," plus any increase made available from storage by other than project works.

From this power site there would be available a theoretical continuous horsepower of 14,200, or a power capacity as defined by the "Manual," which assumes about 70 per cent station efficiency, of 10,000 horsepower. The "Manual" provides that fees be paid upon only such part of this capacity as is practically available for transmission as based upon load factor and forebay storage. The basis of arriving at power site capacity as defined in the new contract on the Pend d'Oreille River, has been copied verbatim from the "Manual" of the Forest Service.

In regard to fees or compensation for the permit the two regulations differ radically. The Forest Service requires a payment in advance of ten cents per horsepower of site capacity at time of filing (same to cover the first year license fee), twenty cents the second year, thirty cents the third year, and similarly until the fee of one dollar is reached in the tenth year, and applied to all succeeding years. These fees are payable from the date of preliminary permit, but are discontinued after the date of commencement of operation for a period equal to that for which fees were paid during survey and construction. The whole regulation seems to have been framed with the idea of preventing speculation in power sites and to discourage applications for permits except by bona fide developers and not by them until nearly ready to develop.

On the other hand, the terms of the Pend d'Oreille contract indicate a much different viewpoint on the part of the new Secretaries. The permittee pays no fees whatever for the first ten years and his fees are then dependent upon his average selling price of energy and upon the proportion of the capacity of the power site then developed, increasing directly as the square of the former and inversely as the square of the latter. The evident purpose is to make it as easy as possible for the project to get on its feet by waiving the fee during the development period of the enterprise, while at the same time encouraging the ultimate full utilization of the site at a low cost to the consumer. The price of energy to the ultimate consumer is limited to two (2) cents per kw.-h. for a consumption of 2000 kw.-h. per year or more at a load factor of 35 per cent or greater, and to six (6) cents per kw.-h. for smaller consumers.

In basing the compensation upon the "average selling price of energy" this average price is defined by the permit to be "the total actual and estimated annual receipts from the sale and disposition of electric energy divided by the total number of kilowatt-hours generated." Since the energy generated is considerably greater than that sold, the price arrived at in this manner is really lower than the actual rates to the consumer.

The permit is indeterminate during compliance with the terms thereof, but may be revoked by the Secretaries for non-payment of fees or other breach of contract and is subject to revisions at intervals of not less than twenty (20) years to conform to then existing regulations.

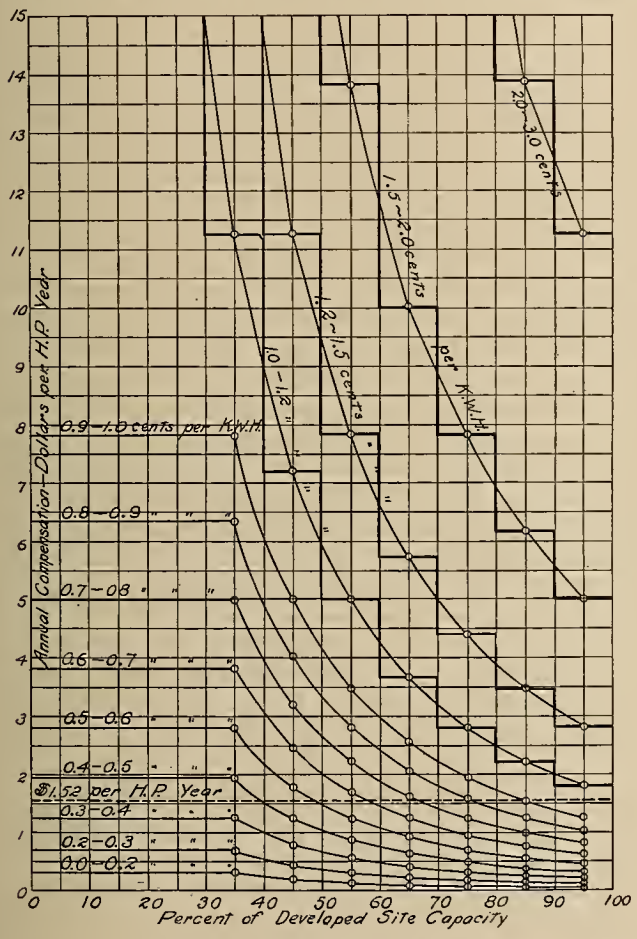
Provision is made for transfer to municipal, state or Federal government at a price to be agreed upon by the parties in interest or by condemnation.

Speculation in power sites is intended to be prevented by a clause in the permit which requires project works to be begun within one year and completed within three years, to the extent of a machine installation rated at 50,000 h.p. or more, which is about 45 per cent of the site capacity of 112,000 h.p.

To arrive at a method of comparing the compensation required under the Forest Service standard contract and under the new joint contract, it must be re-

membered that the former requires payment of fees from the beginning, while the latter waives all compensation for the first ten years. For this reason I have added to the first ten years' actual accumulated fees under the Forest Service permit, compound interest at six per cent upon money so invested up to the time when payments begin under the other permit. This actual payment of fees during the first ten years amounts to five dollars and fifty cents ($5.50) per h.p.) and when compounded at six per cent amounts to seven dollars and twenty-one cents ($7.21) per h.p., thus adding a "going value" of this amount to the capital investment when compared with the other contract.

To make the two fees comparable it will be necessary to add to the former an annual sinking fund assumed to earn three (3) per cent interest and sufficient to replace the first ten (10) years' fees during the remaining forty years of the life of the permit. What may be designated as the "effective annual fee" for the Forest Service permit will then be constituted as follows:



Actual annual fee per h.p.	$1.00
Six per cent of $7.21	0.432
Forty year 3 per cent sinking fund to replace $7.21	0.093
Total	$1.525

On the accompanying diagram the vertical scale represents the annual fee in dollars. The horizontal scale represents the developed proportion of the site capacity and one curve is drawn for each value of the average selling price of energy as defined by the recent contract. These curves should really all be stepped lines as shown in three instances, since the same rate applies from 60 to 70 per cent, 70 to 80 per cent, etc., of developed site capacity. They are drawn as curves through 65. 75 per cent, etc., to avoid confusion of lines.

It is altogether likely that any generating station, the construction of which was originally justified, would be nearly if not entirely loaded up at the end of ten years, thus warranting a completion of structures and machine equipment for the entire site capacity. It should be noted that the fee is based not upon the proportion of the site capacity which is being utilized, but upon the proportion which the permittee is equipped to supply. Thus in most instances only the right edge of the diagram is of much significance.

In this diagram, the heavy dotted line represents the "effective" Forest Service fee of $1.52 per annum, which is constant regardless of per cent of developed site capacity or selling price of energy.

It will be noted that for complete development (95 per cent on the diagram) the energy rate of 1.1 per kw.-h. calls for the same fee under both contracts. For greater prices of energy the fee increases very rapidly, under the new contract, becoming $11.25 per h.p.-year for a price of 2.0 to 3.0 cents per kw.-h. For energy prices below 1.1 cents the fee under the new contract reduces very rapidly to that of 11 cents per h.p.-year for selling prices of about $13 to $20 per continuous h.p.-year, which may be considered as including the range of prices practicable for electrochemical service and to five (5) cents per h.p.-year for still lower prices.

It is rather surprising that the permit in thus making the fee dependent upon the average selling price of energy does not specify in any manner the nature of the service, distance from the point of generation, load factor or any other of these several conditions which must be taken into consideration in judging the charge for energy. Thus it is well known to those in the business that a price of five to ten cents per kw.-hr. to a small consumer for lighting service need not necessarily represent any greater earning on the investment than a wholesale price of one cent or less nearer the place of generation.

This form of permit will surely have the revolutionary effect of separating the business of generation from that of distribution. In such case the permit explicitly prohibits the permittee from having any financial interest whatever in the other company otherwise the fees under the permit will be based upon the ultimate price to the consumer.

In the "Middle West" Wisconsin has just passed through an experience in experimental water power legislation and judicial review which has attracted wide attention particularly through that section of the United States where the riparian rights doctrine is thoroughly established. The Wisconsin legislature in 1911 undertook to repeal all private and local laws granting water power rights both developed and undeveloped and to practically remove all title to water rights from riparian proprietors and vest such rights in the state, subject to use by individuals or corporations under lease from the state. On January 30, 1912, the Wisconsin supreme court declared this law unconstitutional and held the right to develop power to be "unquestionable a private right appurtenant to the riparian land."

The necessity (heretofore) of going to the legisla-

ture for a franchise to obtain the right of eminent domain, together with the necessity of incorporation through state authority makes possible the dictation by the state of terms of development even though such development may be "unquestionable a private right appurtenant to the riparian land."

The new law (Chapter 755, Laws of 1913) passed since the above decision, avoids declaring the power to be the property of the state, but accomplishes the same purpose by the terms imposed upon its development. The entire authority of granting franchises of thirty (30) years duration, approval of design, construction and expenditure of funds, approval of all power contracts, supervision of maintenance and operation, auditing of accounts, regulation of rates, appraisal of values for this purpose or for purchase by municipality or state, is by the act entrusted to the state railroad commission. This commission is by the act authorized to assess all owners of dams now or hereafter constructed, an annual inspection fee not to exceed ten cents per theoretical horsepower to cover the expense of thus supervising the dams of the state. The railroad commission of Wisconsin has thus been given administrative and judicial powers similar to, but far greater than those of the Oregon water board.

One of the noteworthy features of the bill is that, in the regulation of rates and in the event of purchase by the public, the value to be assigned to the lands constituting the power site shall be the value as land only, without any increase because of its adaptability for power purposes and that this appraised value shall in no case exceed the price originally paid by the permittee for these lands. This provision is contrary to all precedent. In the appraisal of public utility properties of all kinds by the various regulatory bodies it has always been assumed as self evident, so far as the speaker is aware, that lands belonging to and useful to the utility as building sites, right of way, etc., should be allowed to appreciate with the values of surrounding property.

Another provision decidedly vicious in character is that "The legislature reserves the right to at any time alter, amend, or repeal any and all franchises granted under this section." If there is any probability that a court would hold this clause to be constitutional, all future development of water power in Wisconsin has been effectually prohibited.

In New York state the further development of water power is said to be going slowly, largely because of the failure of the legislature to recognize the development of water power as a public use, for which the right of eminent domain can be granted, and the failure of the people to amend the constitution if necessary, to authorize its granting for this purpose.

One organization, the "National Conservation Congress," deserves special mention because of its present influence in moulding public opinion upon water power matters. The water power committee of this "congress" at its last annual meeting in November, 1913, was unable to agree upon some of the important questions under consideration. In the interest of progress however, a unanimous report was made covering such principles as could be agreed upon and majority and minority reports were presented relative to disputed points.

It is very gratifying to note especially from the majority report, that the conservation congress as a whole is receding from the position of extreme radicalism which has largely characterized the conservation movement heretofore.

Thus even the unanimous report comes out with the recommendation that "For a definite initial period, sufficient to be financially attractive to investors, the privilege should be irrevocable except for cause reviewable by the courts."

Further recommendations of the unanimous report provide for: subsequent revocation of privilege by payment of physical value; revision of terms of permit every ten years after initial period; assignment of privilege only upon consent of the granting officer; the right to receive compensation for the privilege in the form of a small annual fee until net profits exceed a certain reasonable percentage after which to share increasingly in the net profits.

The majority report emphasizes the necessity of encouraging development in every reasonable way, recognizing that past regulations have discouraged development, and maintaining very properly that true conservation as applied to water power unlike other resources means maximum use and consequent saving of other and exhaustible resources. It declares that hydroelectric development is essentially monopolistic and preferably so, because of the advantages in better service to the public. It looks upon effective public regulation as the remedy for the evils of monopoly.

The minority report on the other hand cites the fact that the great power interests have in recent years increased their control of power, held in an undeveloped state, more than twice as fast as they have increased their control of developed power. It emphasizes very strongly the belief that water power control rather than water power development has been the main purpose of the power interests and that the fight for conservation of water powers is first of all a fight against monopoly, and against the speculative holding of unused powers, implying the inadequacy of rate regulation to relieve the objectionable features of monopoly.

By way of summary it may be said that most recent and proposed regulations have a decided tendency toward a closer government supervision of all the activities of a power company, as to water rights, issuance of securities, sale of power, etc. At the same time these regulations are tending toward greater definiteness in the granting of rights, which is of interest to the operating company.

It may not be out of place to offer a suggestion, at this time, that engineers take a more active part in moulding public opinion on such matters where they are especially qualified to do so. Reform organizations are largely composed of the radical type and must necessarily be so as it usually requires either that all-controlling fire of the fanatic, or a personal motive in the form of political aspirations, to stir the average human nature into active reform work. Allied against them will be those with opposite personal interests working less openly to control the course of legislation. The average disinterested citizen of intelligence will vote perhaps in the proper judicial frame of mind, but otherwise exert little influence.

LETTERS TO THE EDITOR.

Issue Taken on Relationship Between Public and Utility.

Dallas, Texas, March 12, 1914.

Sir:

Referring to the article on "Public Policy of Public Utility Corporations" in the March 7th issue of your journal, and also to your leading editorial on "A Public Policy of Publicity," I do not believe that many of us will agree with Mr. Coleman in his "first principle" of a public utility being a "tenant." As stated by Mr. Coleman, he considers that the public utility is a tenant because it "uses the property, subject to practically any order of the public, * * * and as such a tenant it is evident that our first duty is an accounting of our stewardship." Here Mr. Coleman confuses the idea of a tenant with that of an agent and brings himself in line with Commissioner Max Thelen, who is desirous of forcing the relationship existing between the public and the public utilities into one of "principal and agent."

Mr. Coleman must ackuowledge that if the public utility were merely a "tenant" of the public, that public, as a landlord, could not ask anything more than the carrying out of the original agreements made between the two as landlord and tenant, and it certainly is not within the province of any landlord, in a republic, to ask from his tenant, as a tenant, the information which the public attempts to exact from the public utility, nor to constantly endeavor to exact from that tenant dues, payments and relations which were not either stated or implied in the original agreement. Also, in the last sentence of his second paragraph he changes into the form of "a tenant serving its master (the public) under a contract (franchise)," and thus adds to the confusion of ideas. It would seem, therefore, that Mr. Coleman's "first principle" in this matter is one to which none of the public utilities will assent, and it is only a few of the extremists, like Mr. Thelen, who would claim that the fundamental relationship existing between the public and its untility was that of principal and agent, and, decidedly, there is no basis for Mr. Coleman's claim that the relationship is one of either landlord and tenant of "master" and "tenant" (servant?).

The most reasonable exposition of the real relationship existing between the public and its public utilities is that by Mr. I. F. Dix, in your issue of December 27, 1913, in which he endorses the idea that the relationship is that of "partners." This is absolutely true as regards all of the minor and local public utilities up to within the last year or so. While it may he said that in a great many of the cases the public was a "special" partner in that it had certain rights and privileges in the partnership to which the other partner or partners were not parties, this does not alter the fact that the real relationship was that of partners in a firm, or copartnership, similar to that existing in private mercantile and manufacturing businesses.

With the conclusions derived by Mr. Coleman from this untenable "first principle" there is no quarrel among any of us, except that a great many of us believe that we should not only educate the public as to what we are doing and be absolutely open with them in all matters, but we should go further than this and educate the public as to the actual rights of the public utilities, many of which rights have been lost sight of in recent discussion and many of which have been trampled on, lessened, abrogated, or virtually annulled in the recent war on the public utilities.

I am writing this because I believe that it is unwise to leave unanswered or uncontroverted such statements or claims as those made by Mr. Thelen and by Mr. Coleman in his "first principle." The public and many of its representatives are very prone to take advantage of any slip of the tongue or of the pen from any public utility and to use such as though it were the sentiment of all public utilities. In the past the public utility has lost more and suffered more by its policy of silence under misstatements and misinterpretation than in any other way and the "education" of the public should be such, and along such lines, as are correct and proper and equitable to all concerned, and without fear or favor. The utility has many rights which the public is bound to respect.

Very truly yours,

(Signed) H. S. COOPER.
Secretary The Southwestern Electrical & Gas. Asso.

Asks That Water Power Bill Be Supported.

Seattle, Wash., Mar. 17, 1914.

Sir:

We want, through your columns, to emphatically approve and endorse Senate Bill 4415, introduced by Senator Wesley L. Jones of Washington, for regulation of water powers in the public domain of the United States.

Our Association consists of over one thousand farmers in the central part of the State of Washington, who are owners of about 100,000 acres of some of the best arid lands in the West. Given water, it will produce any crop that can be grown in the temperate zone. It will comfortably support ten thousand people. At present, it is utterly valueless because of lack of water. An ample supply of water at all times of the year flows past its shores, 300 ft. below the land, but the water can only be secured for irrigation purposes through being raised by a pumping plant. The stream that would give the water would also furnish ample power for operating the pumping plant.

Our Association has for years been endeavoring to raise the money to develop the power, and thus through installation of a pumping plant secure the water necessary to irrigate our lands. We have found it utterly impossible to raise a dollar for this purpose owing to the arbitrary and unjust federal laws, under which capital will not invest. As the subject is of vital importance to us, we have carefully studied not only present laws, but every measure that has been introduced into Congress for a number of years, bearing upon the subject.

The federal officials have been absolutely unable to cope with this situation, probably because they have acted solely upon the advice of theoretical conservationists. The Jones Bill comes like a ray of sunlight, and we cannot see how it could be improved except that we do not think it fair for the Government to exact even the five per cent upon the value of its lands, that the bill imposes. The rights of the people are certainly well cared for in that permits are only to be granted to public service corporations, who would thus come under regulation by the public service commission in the state in which the water power is located.

No private interests should be granted these permits, but there is no reason whatever why those interested in any power development, no matter how small, should not incorporate as a public service corporation, and thus place themselves under the supervision of the Public Service Commission as to rates and service.

Our only regret is that our individual situation would not be covered by the Jones Bill, as we are located on a navigable stream, but if the Jones Bill passes, we are sure that it will mean the enactment of similar legislation covering navigable streams, which would cover our case. Congress always has the right to amend or repeal any legislation which it enacts, and we trust that the Jones Bill will be passed exactly as introduced, and without being rendered impossible of utilization through impracticable amendments.

We would like, during our own day and generation, to see our land brought under cultivation, and we think it would be much more to the benefit of future generations for us to hand

down to them our hundred thousand acres of land brought under a splendid cultivation rather than in its present arid condition.

As Senator Jones stated in the admirable speech which he made upon the water power question in the United States Senate, March 5th, out of the total available horsepower in the United States, estimated at 200,000,000 h.p., only about 6,000,000, or three per cent, has been developed. In the interest of all the people, the Government should surely offer every fair and generous inducement to capital to develop its water powers. The farmer is probably more vitally interested in the development of water powers than any other class of our citizens, because only through its development can millions of acres of arid lands in the West and Northwest be reached with water through pumping plants, and only through the use of cheap water power can the greatest known fertilizer, nitrate of lime, be produced. We think that the entire West should get back of the Jones Bill, and do all it possibly can to see it enacted into law.

Having the utmost confidence in the fairness of your views in such matters, from observations of your previous expressions anent similar subjects, we are looking forward to favorable comments through your columns in an early issue, and remain,

Very respectfully,

(Signed) MILTON E. DAM,

President The Priest Rapids Land Owners Association.

Electric Railways of the United States are dealt with statistically in a report just issued by the Bureau of the Census. The report comprises preliminary figures of the forthcoming quinquennial report of the Department of Commerce and were prepared under the supervision of W. M. Steuart, chief statistician for manufactures. The statistics relate to the years ending December 31 for 1912 and 1907, and June 30 for 1902, the last two dates being used for comparison. The totals include electric light plants operated in connection with electric railways and not separable therefrom, but do not include reports of mixed steam and electric railroads nor railways under construction during the census year which had not begun operations. The figures as presented for continental United States show general gains for the decade 1902-1912. The number of operating companies increased from 817 in 1902 to 975 in 1912, or 19 per cent. There were 41,065 miles of track in 1912 as compared with 22,577 in 1902, or an increase of 82 per cent. The persons employed numbered 282,461 in 1912 as compared with 140,769 in 1902, or an increase of 101 per cent. The revenue passengers carried in 1912 numbered 9,545,554,667 as compared with 4,774,211,904 in 1902, or an increase of 100 per cent. The gross income in 1912 amounted to $585,930,517 as compared with $250,504,627 in 1902, or an increase of 134 per cent. The operating expenses amounted to $332,896,356 in 1912 as compared with $142,312,597 in 1902, or an increase of 134 per cent. The plants aggregated 3,665,051 h.p. in 1912 as compared with 1,349,211 h.p. in 1902, or an increase of 172 per cent. The 49,153 h.p. in water wheels in 1902 increased to 471,307 h.p. in 1912, or 859 per cent. The output of stations amounted to 6,052,699,008 kw.-hr. in 1912 as compared with 2,261,484,397 kw.-h.p. in 1902, or an increase of 168 per cent. The current purchased in 1912 amounted to 2,967,318,781 kw.-hr., the figures for 1902 not being available.

WASHINGTON ELECTRIC RAILWAYS.

Preliminary figures of the forthcoming quinquennial report on the electric railways of the state of Washington have been given out by the Bureau of the Census, Department of Commerce. They were prepared under the supervision of the chief statistician for manufactures.

The statistics relate to the years ending December 31 for 1912 and 1907, and June 30 for 1902. The totals include electric light plants operated in connection with electric railways and not separable therefrom, but do not include reports of mixed steam and electric railroads nor railways under construction during the census year which had not begun operations.

The figures as presented for the state of Washington show substantial gains for the decade 1902-1912. The number of operating companies increased from 8 in 1902 to 19 in 1912, or 137 per cent. There were 1036 miles of track in 1912 as compared with 229 in 1902, or an increase of 352 per cent. There were 4761 persons employed in 1912, as compared with 1339 in 1902, or an increase of 256 per cent. The number of revenue passengers carried was 126,686,767 in 1912 as compared with 41,544,228 in 1902, or an increase of 205 per cent.

The figures are given in detail in the accompanying table:

Washington.

	1912.	1907.	1902.	Per cent of increase:[1] 1902-1912.
Number of companies	20	15	8	150.0
Operating	19	14	8	137.5
Lessor	1	1	.....	.....
Miles of line	739.07	563.48	181.89	306.3
Miles of single track.	1,035.92	764.73	228.93	352.5
Miles of single track in state[2]	991.17	730.27	228.93	333.0
Cars, number	1,904	1,762	431	341.8
Passenger	976	791	312	212.8
All other	928	971	119	679.8
Electric locomotives	28	19	.....	.....
Persons employed	4,761	4,126	1,339	255.6
Salaried employes	624	362	89	601.1
Wage earners, (average number)	[3] 4,137	3,764	1,250	231.0
Power:				
Horsepower, total	245,817	39,602	14,457	1,600.3
Steam and gas engines (including turbines):				
Number	28	41	34	—17.6
Horsepower	53,767	34,702	13,132	309.4
Water wheels:				
Number	43	3	5	760.0
Horsepower	192,050	4,900	1,325	14,394.3
Kw. capacity of dynamos	152,630	28,679	9,626	1,485.6
Output of stations, kw.-hr.	439,408,062	25.516,954	20,649,562	2,027.9
Current purchased, kw.-hr.	69,385,927	[4]	[4]	.....
Passengers carried	163,717,821	142,496,001	42,533,743	284.9
Revenue	126,686,767	110,506,620	41,544,228	204.9
Transfer	30,226,149	29,951,966	989,515	.....
Free	6,804,905	2,037,415	[4]	.....
Car mileage (passenger, express, freight etc.)	29,516,695	24,364,214	8,378,420	252.3
Condensed income account of operating companies:				
Gross income[5]	$13,590,933	$8,402,560	$2,542,906	434.5
Operating expense	$7,116,198	$5,140,501	$1,576,018	351.5
Gross income less operating expenses	$6,474,735	$3,262,059	$966,888	569.6
Deductions from income (taxes and fixed charges)	$4,033,973	$1,788,314	$463,101	771.1
Net income	$2,440,762	$1,473,745	$503,787	384.5

[1] A minus sign (—) denotes decrease.

[2] Excluding track lying outside of state of companies within state.

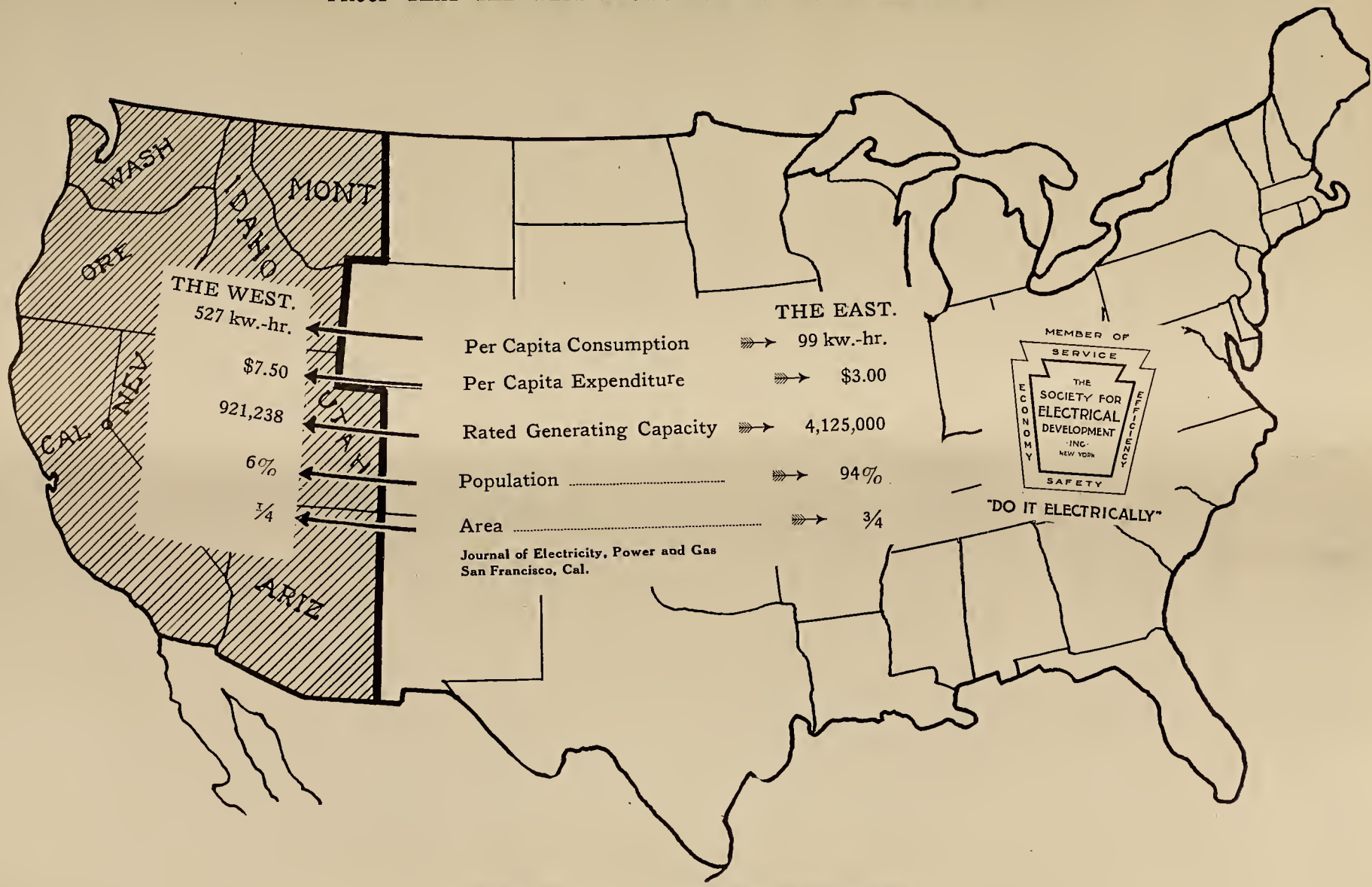
[3] Number employed Sept. 16, 1912.

[4] Figures not available.

[5] Income from sale of current for light and power included: In 1912, $4,422,080; in 1907, $1,182,423; and in 1902, $641,800.

Note:—The large increase in power and output of stations from 1907 to 1912 was due in part to the consolidation of light and power and railway companies.

PROOF THAT THE WEST KNOWS HOW TO "DO IT ELECTRICALLY."



Compiled from the 1912 U. S. Census Report on Electric Lighting.

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Regulations Obstruct Development

In this issue is published a letter which states that over one thousand farmers owning collectively about one hundred thousand of the best acres of the semi-arid lands of the State of Washington, find that land rendered practically valueless because of lack of water.

Yet all the days of the year water sufficient for the needs of this thirsty land—sufficient to enable it to support an estimated population of ten thousand people—flows idly past.

The reason given is that the water would have to be raised three hundred feet and that while this could be accomplished by the power extracted from the water, federal laws affecting this development are so arbitrary and unjust that capital cannot be attracted to the project.

With the conditions as stated, is this reasonable or just?

Oppressive laws were ever repugnant to a free people—a sovereign people. The remedy is the abrogation of the unjust laws.

The point may also be raised that such laws are unconstitutional, in that they prevent the development of the resources of a State, even in accordance with its laws.

The country should be so administered that its resources will be used to benefit the greatest number of people and not allowed to run to worse than waste.

Is is not more sane to leave to posterity an inheritance of cultivated acres, with comforts electrical and other necessities and conveniences, than to pass on to them unimpaired, an undeveloped power site and a waste of arid lands?

As a nation, let us cry a halt to the power that impoverishes by preventing development and by ignoring the necessities of the now.

Development Control

Pondering the foregoing and many other arguments brought to mind, there are undoubtedly many who will disagree with the statement made early in the concluding instalment of Mr. L. B. Harza's able presentation and comprehensive review of new and proposed regulations affecting water power development, which appears in this issue, to the effect that "the department of agriculture, through ownership of the forest reserves, is able to and does dictate terms to control water power development."

The act establishing forest reserves, stated that they could be created, among other purposes, for securing favorable conditions of water flows.

Under certain conditions, forests do advantageously control water flow, but there are conditions conducive to the opposite effect. There are also other important regulatory factors.

It is fully established that the dams necessary to hydroelectric development to store the flood waters—which may be flood waters despite the forest reserves—are beneficial in their effect upon stream flow.

Due to these dams water otherwise running to waste may be used for irrigation or for domestic purposes.

This was undoubtedly recognized at the time of passing the act, for it provides that all water on forest reserves may be used, in accordance with the law, for domestic, irrigation and other purposes.

From the provisions made it would seem that it is the duty of the secretary of the department having jurisdiction to do everything possible to facilitate the development of water power possibilities located within forest reserves, as furthering the objects for which the reserves were created.

The act also stated definitely the nature of the rules which the administrating department could make. Although there are later acts and provisions than the original, it is said that none pretend to alter the purposes for which the reserves could be created or the substance of the rules the administrating department is authorized to make.

The need for the most beneficial use of water is so apparent as to require no justification or defense, and this act, recognizing this principle, directs that the water shall be so used.

But the control of the development of water power is, almost entirely throughout the West, vested in the State. The act in such cases may therefore be construed, that the secretary of the department having jurisdiction shall formulate rules which shall facilitate the state's administration of these resources. The state having authorized certain water power developments, the law then provides for the easy co-operation of the federal government in the granting of the rights of way across forest reserves and for other concessions needed for the proper realization of the ends sought.

Within such reserves the laws with respect to the appropriation and use of water are, as they should be, in full force and effect. Consistent with local rights and necessities, the act implies that the reserves shall not be closed to such use.

Furthermore, there is the possible construction that the fees charged and collected by the Government for the beneficial use of water within forest reserves is in the nature of an excise tax—a tax upon industry and prohibited under the Constitution unless levied uniformly, throughout the United States.

Mr. Harza's statement may, and undoubtedly does, describe an actual artificial condition, but from the foregoing recital it would appear that it may not have the support of law.

While the United States Government has a proprietary right in the reserves, it has no municipal right, neither may a bureau make regulations nor collect tolls except in accordance with existing provisions of constitutional acts of Congress.

A Water Power Competitor

One is apt to refer to the people as a body apart from private corporations which are naturally composed of a part of the people. It is in this sense, that ownership of water power possibilities is said to belong to the people.

They do, but unless utilized by the people or their use delegated to others, this Tantalus of nature's wealth will some day surely mock them.

Through their representatives, and either with or without their consent, the people are endeavoring to extort from private corporations the utmost penny for the use of their property, blind to the fact that their ownership does not constitute at this time a monopoly, as they are to the further fact, that this form of taxation does not increase wealth.

Where collected in connection with the operation of a public utility, it increases operating costs, and the taxes collected and returned to the people, add to the cost of the product the interest on those taxes which, incidentally, are also reduced by the amount necessary to their collection and disposition before being returned.

A tax upon a utility is an added burden upon the consumer.

The private corporation operating public utilities has been forced into the position of a buyer of power. This is bought in a competitive market. Your private corporation may use water power, steam power, or gas.

With steam power at the present time there is no undue governmental "control" resulting in a heavy burden of taxation or of legal expenses. It is therefore reasonable to suppose that invention and progress will be directed along the line of the use of steam power. An efficiency of production may in this way become so possible that the present undeveloped water power of the people will remain a waste, as in former years.

If private corporations held such magnificent resources within their control, but failed absolutely to make them profit-producing, the public, with the shoe then on the other foot, would deride, condemn and probably strive to confiscate.

A premium upon water power development may yet prove the eager reward of the people to the private corporation.

An interesting condition is pointed out by Mr. Crawford in this issue where central station companies have found it most profitable to purchase power from large lumber mills. Excessive taxation and legal and engineering water power development expenses have in this way been avoided.

In California and Oregon, notwithstanding their enormous water power awaiting development, the central station electric light and power plants have a practically equal generating capacity of water and steam power. In both these states power generating conditions are competitive. The property of the people is running to waste.

In the larger cities, skyscrapers and extensive buildings with their private installations may also prove ultimate water power competitors by co-operating with central stations in the operation of their steam power plants.

These arguments suggest still further the necessity for handling the water power situation to suit local conditions and the absurdity of endeavoring to frame a nation-wide panacea ignoring these, by endeavoring, for example, to charge a uniform rental where conditions are not uniformly comparable.

A continuance in the present course may some day find the people without a market for their product and unable even, for economic reasons, to sell it to themselves.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

F. H. Leggett, Pacific Coast manager Western Electric Company, is at Los Angeles.

Harry Adams of the Phillips Insulated Wire Company, Pawtucket, R. I., was in Seattle during the past week.

H. G. Lacey, proprietor of the Hanford Water & Power Company, Hanford, Cal., was a San Francisco visitor last week.

H. Frickey, engineer Northern California Power Company, was at San Francisco from Redding, Cal., during last week.

Harry Kirkland, vice-president and manager of the American Conduit Manufacturing Company, spent two days in Seattle, this week.

L. E. Torrey, electrical engineer, has left for Riverside, Cal., on business, and expects to be away from San Francisco for about one month.

M. W. Hull, manager of the California office of The Hess Flume Company, was at San Francisco from Los Angeles during the past week.

Geo. A. Boomer, Pacific Coast representative Plume & Atwood Manufacturing Company, with offices at San Francisco, is at Seattle on business.

J. B. Lukes, representative Stone & Webster Construction Company, is visiting the Truckee River General Electric Company's plant at Reno, Nev.

A. H. Noyes, salesman Electric Appliance Company, will return to Oregon from California where the past few weeks have been spent on company business.

J. H. Larmouth has been appointed manager of the Edmonton Municipal Electric Railway System, Edmonton, Alta., vice **W. T. Woodroofe**, superintendent, resigned.

F. E. Newbery of Newbery, Bendheim Electric Company, who has been spending the past month at Los Angeles, is expected to arrive in San Francisco this week.

D. G. Smith, of Smith & Hemenway, manufacturers of "Red Devil" tools, is returning to New York from the Pacific Coast by way of Los Angeles and Salt Lake City.

Paul A. Shilton, Los Angeles representative of R. J. Davis, district sales agent of Century Electric Company, St. Louis, has left on an extended tour of Arizona and New Mexico.

J. Harry Pieper, assistant general agent, Southern California Edison Company, Los Angeles, Cal., received the sad news last week of the sudden death at Boston, of his mother.

E. R. Murray, salesman for the Western Electric Company in the San Joaquin Valley, has just returned from a combined vacation and business trip to the Hawaiian Islands.

C. B. Hawley, manager of the Intermountain Electric Company, has returned from Pocatello, where he has spent a week in connection with company business in that territory.

M. G. Adler, chief draughtsman bureau of Los Angeles aqueduct power at Los Angeles, Cal., has been transferred to the grade of member in the American Institute of Electrical Engineers.

W. H. Trask, formerly commercial agent of the Idaho Railway, Light & Power Company, has taken a position in the commercial department of the Utah Power & Light Company at Salt Lake City.

Geo. R. Thomson, representing R. J. Davis, district sales agent of Century Electric Company, has just returned to San Francisco, having visited all the cities and towns in the San Joaquin Valley.

W. S. Heger, formerly Pacific Coast manager for the Allis-Chalmers Company, has been appointed manager Pacific Coast sales division Busch-Sulzer Bros. Diesel Engine Company, with offices in the Rialto Bldg., San Francisco.

Lewis Degen, of Long Beach, California, has been invited to address the newly appointed Fire Alarm Commission of Los Angeles, by that body so that they may have the benefit of his experience and ideas as a fire alarm expert.

B. H. Scranton, president, and **Frank Kuhn**, vice-president of the American Electrical Heater Company, were in Seattle during the last week, but spent Thursday in Tacoma in company with **H. D. Brainard**, Seattle sales manager of the Western Electric Company.

J. T. Stewart, who has, since the discontinuance of the San Francisco warehouse of the Holophane Works of General Electric Company, been employed in the city sales office of Dunham, Carrigan & Hayden, has again joined the forces of the former company as city salesman.

F. A. Osborn, University of Washington, Seattle, Wash., has been appointed a member of the National Membership Committee of the Illuminating Engineering Society. Other Pacific Coast members of the committee are **F. H. Murphy**, Portland, Oregon; **R. H. Manahan**, Los Angeles, Cal., and **H. E. Grant**, San Francisco.

Belvidere Brooks, formerly in charge of the Denver office, will succeed **Theodore N. Vail**, as president of the Western Union Telegraph Company, according to apparently authentic information received, which states that the new appointment will become effective as soon as the Western Union has been divorced from the American Telephone & Telegraph Company.

F. D. Schwartz, general sales manager Indiana Rubber & Insulated Wire Company, Jonesboro, Ind., is at San Francisco on a business trip being made in the interests of his company through the western territory. Mr. Schwartz was previously city sales manager in the Chicago office of the Electric Appliance Company. He will return East by way of Los Angeles and Salt Lake City.

N. W. Reed, inspecting engineer, Board of Fire Underwriters of the Pacific, at San Francisco, for the past seven years, has resigned from that position on account of sickness and general nervous breakdown. During his service he has been instrumental in improving standards of electrical construction and in creating a stronger feeling of co-operation and harmony with the electrical contractors throughout California. It is with regret that his many friends have learned of his resignation and while his plans for the future are undecided it is hoped that he will finally again locate in this district.

R. J. McClelland, chief engineer of the Electric Bond & Share Company of New York City, accompanied by **Louis Elliott**, New York engineer of the same company for the Utah, Idaho and Colorado district, **H. H. Dewey**, engineer for the General Electric Company in the power and mining department, handling matters in the same territory, and **F. C. Green**, engineer of the transformer department at the Pittsfield Works of General Electric Company, have been at Salt Lake City during the past week going over the system of the Utah Power & Light Company, particularly with reference to the 110,000 volt transmission system which that company proposes to place in operation in the near future.

Bertram Smith has just arrived in San Francisco, having been appointed assistant manager of the Edison Storage Battery Supply Company with headquarters in that city. Mr. Smith was originally with the American Bicycle Company as manager of the Buffalo plant and later with the National Battery Company as secretary and treasurer for a period of three years, after which he joined the sales force and remained with the National Battery Company up to 1908 when it was absorbed by the United States Light & Heat Company of Niagara Falls. He was with the United States Light & Heat Company for six years working principally out of the Chicago office, and during that time actively engaged in railway car lighting work, automobile lighting and electric self starters. Mr. Smith is very well known all over the United States in his field.

MEETING NOTICES.

Portland Sections, A. I. E. E. and N. E. L. A.

The next joint meeting will be held at 8:00 p. m. April 7th in the Hawthorne Building. The paper of the evening will be given by F. D. Weber, electrical inspector of the Underwriters' Equitable Rating Bureau on the subject, "Is Underwriters' Inspection Necessary in Oregon?"

Seattle Bell Telephone Society.

The Bell Telephone Society of Seattle held its monthly meeting at Eilers Hall, Tuesday, March 17th. The technical paper of the evening was read by District Commercial Engineer S. M. Treen on "Commercial Practice." The entertainment committee presented an interesting program.

Seattle Jovian League.

The Seattle Jovians held their weekly luncheon at the Lincoln Hotel Friday, March 20th, when a committee appointed to look into the advisability of establishing a permanent exhibit of electrical apparatus for use of architects and builders reported progress. There was a good attendance.

Los Angeles Section A. I. E. E.

The regular meeting of the Los Angeles Section of the American Institute of Electrical Engineers, on March 25th, was devoted to a lecture by Max Loewenthal, upon "Electricity as a Source of Heat." As it was ladies' night, the speaker introduced a number of interesting experiments, slides and moving pictures, which showed the advantages of electricity in the home.

Safety First Meeting at Seattle.

The members of the Safety Committee of the Puget Sound Traction, Light & Power Company were guests of the company at dinner at the Washington Annex Hotel Wednesday, March 18th. There were one hundred and fifty members present and addresses were presented by H. D. Henderson, Hugh A. Tait, A. J. Falknor, J. F. Cooper, H. S. Elliott, Dr. Park Weed Willis and A. L. Kempster.

San Francisco Electrical Development and Jovian League.

"An Outline of the Life and Work of George Westinghouse," was ably presented by Thos. E. Collins at the regular weekly meeting held at the Hof Brau last Tuesday. At the conclusion resolutions were adopted recording the sorrow of the league at the death of the great inventor and manufacturer. The resolutions were ordered spread upon the minutes and the address presented by Mr. Collins made a permanent record in the archives of the league.

Oregon Society Engineers.

The next regular meeting of the Oregon Society of Engineers will be held in room "A" of the Public Library, Portland, Oregon, at 8:00 p. m. April 15th.

The speakers of the evening will be John H. Lewis, state engineer, who will speak on the accomplishments of his office during his incumbency as state engineer. Fred F. Henshaw, district engineer, Water Resources Branch, United States Geological Survey, on "Stream Gauging in Oregon." E. G. Hopson, supervising engineer, U. S. Reclamation Service, "Government Co-operation in the Celilo Project." These talks will be all illustrated with lantern slides.

Utah Electric Club.

At the regular weekly luncheon held at the Salt Lake Commercial Club Thursday, March 19th, George J. Henry, consulting hydraulic engineer at San Francisco, who is at Salt Lake City on special business, gave some very interesting reminiscences connected with the installation of the first water power plants in Utah, and told something of the recent developments and performance of high head plants now in operation.

W. F. Jensen, president of the Salt Lake City Commercial Club, the regular speaker of the day, took for his subject, "The Building of a Metropolis." He pointed out the futility of attempting to build a great city without first developing the territory tributary to it, and indicated the prominent part which electricity is playing in the development of the territory contiguous to Salt Lake City, and how its use may be still further extended particularly in its application to the farming, poultry and dairying industry.

The Jovian Electrical League of Southern California.

In view of the intense interest which everyone in the Southland, especially the electrical fraternity, is taking in the power controversy between the city of Los Angeles and the three power companies, a record attendance occurred last Wednesday at the meeting held at Los Angeles, to hear the companies' side of the case as presented by R. H. Ballard, general manager of the Southern California Edison Company. Mr. Ballard reviewed the entire situation with a view of showing the disloyalty and lack of foresight on the part of the city council and the defensive attitude which the companies will have to assume for the protection of their own bondholders as well as the public. He pointed out the folly of permitting the city during the five year lease period to alter the distributing systems of the companies and the illegality and therefore impossibility of the companies to binding themselves at this time to sell the system at the end of the five year period. Now the council proposes the shortsighted and dangerous policy of condemning the systems, after the companies' thirty years' struggle to build up a legitimate business. It is hard to predict what such a policy would mean to investors proposing to put money into California public utilities. The companies, resisting such an arbitrary course, would take the matter into the state courts, and should they lose, the bondholders would then take the matter into the U. S. Supreme Court which would precipitate a long drawn out legal struggle. The combined power house and distributing system bond issue is, furthermore, contrary to the provisions of the city charter, according to Mr. Ballard. He predicted the defeat of the bond issue on May 5th, which will be conducted at an expense to the taxpayers of $40,000. The speaker, after the able presentation of his argument, was loudly cheered and a vote of thanks was tendered through E. R. Northmore, the chairman of the day.

The announcement by Max Loewenthal that the Society for Electrical Development had been successful in obtaining the subscription fund of $200,000 and was now ready to begin operations, was greeted with applause, and his resolution endorsing the establishment of a Pacific Coast office of the Society was adopted unanimously.

N. E. L. A. COMMERCIAL SECTION MEMBERSHIP CAMPAIGN.

An active membership campaign is being conducted by the Commercial Section of the National Electric Light Association, under the aggressive leadership of Mr. J. F. Becker, commercial agent of the New York Edison Company, who has appointed "captains" of each state. These are now circularizing those eligible for membership, and the results are already gratifying.

Central station men (Class B members), jobbers and manufacturers' representatives and electrical contractors (Class D members), may all become members of the commercial section and enjoy the many advantages which it offers.

The dues are merely nominal, and are more than offset by the value of the practical publications mailed to members of this section.

The commercial section enjoys a prominent place in the activities of the N. E. L. A. and is said to be the most active off-spring of the parent association. Its work, especially in standardizing methods is of great value to all.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS.

California Section.

C. W. Mitchell, president. W. G. Pennycook, vice-pres.
John W. Carrell, sec-treas., 55 Fulton street, San Francisco.

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correllate the answer from the several Inspection Districts as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

The California Section of the N. A. E. I. held its second meeting at the office of the Board of Fire Underwriters of the Pacific, 914 Merchants' Exchange Building, San Francisco, Saturday, March 14th. The next meeting of the section will be held at the same place on March 28th.

By the Secretary.

The battle is on. We can read a lively sermon in the mighty array of interrogation points. At first we were apprehensive lest the electrical public should not take kindly to our question-box, but our fears have melted away. Questions came in before they were invited. We know our work, our destination, and we are on the way.

To take rise from its origin and exist is one incident in the natural order of things. To develop and succeed is the result of healthy sustenance and mental effort. The chief sustaining force of this organization is public interest in the concrete form of questions on electrical construction met with in practice. If you wish us success send in your questions.

IDAHO PUBLIC UTILITIES COMMISSION.

Arising out of the complaint of the village of Wesdell against the Great Shoshone & Twin Falls Company to the effect that its rates were excessive and discriminating, the commission ordered that the company, and the Idaho Power & Light Company and the Beaver River Power Company also made party to the proceedings, collect all outstanding bills so that all consumers should be fully paid up and further ordered the schedule of rates to be charged in the village and in the towns of Mountain Home, Glens Ferry and Gooding.

As a result of complaints being made by numerous customers of the Southern Idaho Water Power Company the commission ordered the rates which should be charged by the company at American Falls, Pocatello, Fort Hall and Blackfoot. These range from 9 cents to 4 cents per kw.-hr., with a monthly minimum of one dollar per month.

The Homedale Water, Power & Light Company was granted a certificate of public convenience and necessity for the construction of a water system within the village of Homedale.

In the matter of establishing uniform rates to be charged by central station companies as instigated by the commission it was ordered that they be established. Schedule A covers commercial and residence lighting and ranges from 9 cents to 3 cents per kw-hr., Schedule B, a domestic cooking rate of 2½ cents per kw.-hr., and Schedule C a commercial cooking rate based upon the monthly guarantee per connected kw., and ranging from a guarantee of $1.50 with a rate of 2 cents per kw.-hr., to $3.50 guarantee, which permits a one cent rate. All are subject to a discount of ten per cent for prompt payment and Schedules A and B to a monthly minimum charge, irrespective of connected load of $1 per month.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The Oceanside Electric & Gas Company has been granted authority by the commission to renew notes in the sum of $12,442, and to issue its six per cent twenty year bonds in the sum of $25,000, a sufficient number of which will be sold by the company at ninety per cent of the par value so as to net the applicant $14,100, which sum will be applied to the payments of the notes and to reimburse the treasury for additions and betterment.

The commission has rendered a decision granting authority to the Pacific Freight Traffic Bureau, which includes the Southern Pacific Company and the Atchison, Topeka & Santa Fe Railway coast lines, to change the classification of oil barrels or drums and glycerine barrels. A slight increase in less than carload shipments results, with a decrease in carload charges.

The Atchison, Topeka & Santa Fe Railway Company, the Southern Pacific Company, the San Pedro, Los Angeles & Salt Lake Railroad Company, the Western Pacific Railway Company, have filed application with the commission asking authority to amend fares, rules and regulations with respect to drawing rooms and compartments in standard Pullman sleepers.

The commission has issued an order instituting on its own initiative, an investigation into the rates charged for natural gas delivered at the limits of the city of Long Beach, Los Angeles county.

The commission has instituted an investigation on its own initiative into the rates, services and extensions of the Pacific Gas & Electric Company in its San Jose district.

The commission rendered a decision upon the application of the Southwestern Home Telephone Company of Redlands for authority to issue $101,300 in short term notes and to pledge $197,000 in bonds as collateral security therefor. The commission does not make a final ruling in the case but states that it will hold the matter in abeyance until July 1, 1914. It directs the company to take steps to reduce its indebtedness, both floating and bonded indebtedness. The commission also calls upon the company to arrange to cancel $300,000 in stock which was issued originally on a contract by which the company had the right to retire it upon the payment of $3,750.

William G. Henshaw, as proprietor of the Crescent City Railway Company, has made application to the commission for a certificate of public convenience and necessity authorizing the Crescent City Railway Company to construct a system of street car lines in the city of Rialto, San Bernardino county.

The San Diego Consolidated Gas & Electric Company has filed an application with the commission asking the authority of the commission to float a bond issue of $18,000 to reimburse the company for expenditures, additions and betterments.

The commission has granted a decision authorizing the transfer of the Deer Creek Rural Telephone Company, Tulare county, to the Pacific Telephone & Telegraph Company.

The Oakdale Gas Company has filed an application with the commission for a certificate of public convenience and necessity, authorizing it to exercise rights granted under a franchise to do business in Stanislaus county.

The commission has rendered a decision authorizing the sale of $15,000 preferred stock of the Pitt River Power Company to be sold at not less than 80 per cent of the par value. The funds are to be applied to the development of the applicant's hydroelectric system at Burney Falls.

The commission has rendered a decision modifying in some respects its readjustment of the long distance telephone rates of the Pacific Telephone & Telegraph Company in the state of California and directing that the new and reduced rates should go into effect on or before March 21 of this year. The commission's order, instituting an entire

new schedule of long distance rates, will mean a reduction of approximately $506,000 in the sum now paid annually by the people of California for long distance service. In its present order the commission makes two changes from its original decision in this matter. The first change affects the rates within the 44 mile zone. The second change affects the two party service.

The commission has issued an order granting the San Joaquin Light & Power Company authority to refund existing notes in the sum of $200,000.

The commission has issued an order in which it finds that the Western States Gas & Electric Company has been discriminating among its patrons in the vicinity of Lodi, San Joaquin County, and has been affording to some of its patrons rates which are lower than the rates on file with the commission. In its order the commission directs that the Western States Gas & Electric Company shall cease its discrimination and shall put into effect a new rate for agricultural service. The commission states further that if this new rate is not as low as the lowest rate now being given to those patrons in whose favor it has been discriminating the commission will institute an investigation into all of the rates, regulations and practices of the company and that this investigation will also include a consideration of the "conduct of the company in departing from the legally established rates and schedule on file with this commission."

The Napa Valley Electric Company has applied to the commission for a certificate of public convenience and necessity asking for authority to operate in the territory now occupied by the Calistoga Electric Company which is serving the town of Calistoga and vicinity.

S. Waldo Coleman has filed an application with the commission asking that the commission grant a certificate of public convenience and necessity, authorizing him to maintain and operate a gas plant and distributing system in the towns of Concord, Martinez, Antioch, and the city of Pittsburg, Contra Costa county.

The commission has cited the California Natural Gas Company of Bakersfield and the West Side Gas Company of Taft, to show cause, April 4, before the commission at San Francisco, why an investigation should not be made into the rates charged for natural gas by the companies.

The Pacific Gas & Electric Company has filed an application with the commission asking authority to issue five per cent one year collateral gold notes in the aggregate sum of $7,000,000, to be sold at not less than 96.5. Five million dollars of the sum asked will be employed in discharging and refunding the company's six per cent gold notes now outstanding. The balance of the issue will be employed in reimbursing its treasury and for additions and betterments.

The Ventura County Power Company has made application to the commission asking authority to issue $200,000 five year six per cent notes. The funds to be derived from the sale of the notes will be employed in refunding outstanding obligations aggregating $120,850. for the construction and completion of a power line and a hydroelectric generating plant to be used by the Ventura Water System.

The Western States Gas & Electric Company has filed an application with the commission asking that the contract between the applicant and the Sierra & San Francisco Power Company, dated December 4, 1911, by which the Sierra & San Francisco Power Company delivered electric energy to the Western States Gas & Electric Company at Manteca at a price of 8¾ mills per kw.-hr., be amended. The Western States Gas & Electric Company objects to the contract upon the grounds that the price is excessive, that the conditions in the contract relating to the load factor are confiscatory, that the Sierra & San Francisco Power Company is discriminating in favor of other companies, and that the life of the contract is unreasonably long.

Frank Kummeth has filed an application with the commission asking authority to sell the Sanger Water Works to the city of Sanger, in Fresno county. The city of Sanger has voted a bonded indebtedness of $32,400 to acquire a municipal water plant and Mr. Kummeth is now negotiating the sale of his properties to the municipality.

The Northwestern Pacific Railroad Company has filed an application with the commission asking authority to issue bonds in the sum of $5,543,000. The issue will be sold to the Southern Pacific Company at 95 per cent and the bonds will bear 4½ per cent interest, secured by a mortgage and deed of trust to the Farmers' Loan & Trust Company, executed March 1, 1907.

INTERNATIONAL ENGINEERING CONGRESS, 1915.

Rapid progress is being made in working out the final program of papers for the International Engineering Congress to be held at San Francisco in 1915.

The first volume of the publication of the Congress will consist of a series of articles descriptive of the various technical features of the design and construction of the Panama canal. The various topics which will be treated are noted in the following list:

(1) Introductory Chapter.
(2) Dry Excavation for the Panama Canal.
(3) Dredging in the Panama Canal.
(4) Terminal Works, Dry Docks, and Wharves of the Panama Canal.
(5) Permanent Shops of the Panama Canal.
(6) Coaling Plants and Floating Cranes of the Panama Canal.
(7) Meteorology and Hydrology of the Panama Canal.
(8) Design of Locks, Dams, and Regulating Works of the Panama Canal.
(9) Method of Construction of the Locks, Dams, and Regulating Works in the Atlantic Division of the Panama Canal.
(10) Method of Construction of the Locks, Dams, and Regulating Works in the Pacific Division of the Panama Canal.
(11) Design of Lock Walls and Valves for the Panama Canal.
(12) Design of the Spillways on the Panama Canal.
(13) Gates of the Panama Canal Locks.
(14) Electrical and Mechanical Installations of the Panama Canal.
(15) Emergency Dams Above Locks of Panama Canal.
(16) Municipal Engineering and Domestic Water Supply in the Canal Zone.
(17) Reconstruction of the Panama Railroad.
(18) Aids to Navigation of the Panama Canal.
(19) Geology of the Panama Canal Zone.
(20) The Working Force of the Panama Canal.
(21) Sanitation in the Panama Canal Zone.
(22) Purchase of Supplies for the Panama Canal.

Each of these topics will be treated by someone on the canal force who has been responsible for the design and construction described. The introductory chapter as well as the topic of Dry Excavation for the Panama Canal will be handled by Colonel Goethals himself.

This volume will constitute practically an official technical record of the gigantic engineering feat which is just nearing completion and will be of interest, not only to engineers but to laymen. No similar volume has as yet been prepared upon the canal, nor is it probable that any such will be in the future. The advantage is being taken of the congress to draw together under one cover in this way, the statements of the men who have been responsible for the work.

The program of papers for the various sections of the congress is practically completed and notices of them will be published in the near future. Subscriptions to the congress are being received daily and on March 1 the number of enrollment was slightly in excess of 1200, of which over 200 are from foreign countries and about 1000 from the United States. Subscription blanks have been mailed through the various National Societies to many thousands of engineers in this country and through the foreign societies to foreign engineers. The response already received is very encouraging, but it is trusted that all engineers interested in the success of the congress will not fail to send in their subscriptions as early as possible. Delay in so doing renders the task of the committee of management more difficult, and makes it impossible to form any just estimate of the receipts which may be expected and the number of copies of the volumes which have to be published.

ANNUAL REPORT BELL TELEPHONE COMPANY.

The continued growth of the Bell System, its earnings and expenses and general financial prosperity, its attitude as to government ownership, its agreement with the Department of Justice, the sale of its Western Union holdings and its relation with the general public are all set forth in detail in the annual report of the American Telephone & Telegraph Company just issued. President Theodore N. Vail states that the common impression that the Postmaster General has made a report favoring the acquisition of the wire lines is erroneous. As to possible government purchase, Mr. Vail quotes Congressman Lewis, the Congressional exponent of government ownership, to the effect that there is no water in the Bell capitalization; and urges the stockholders not to be induced to part with their holdings through fear of confiscation. Americans are better supplied with telephone facilities than any other people, having six times as many telephones per capita as Great Britain and thirteen times as many as France, and that the rates here are as popular as those of any government-owned plant. Europe has only two-fifths of the telephone traffic of the United States..

During the past year subscribers' telephone stations have increased until now there are 8,133,017, a gain of 676,-943. These stations reach 70,000 localities or 10,000 more than the number of postoffices. The total wire mileage is 16,111,011, of which 92 per cent is copper. More than half the wire mileage is underground, the total underground plant representing a cost of $181,500,000. The number of daily telephone connections showed a growth of nearly two million, reaching an average of 27,237,000 a day.

The extension of the telephone plant during the year amounted to $54,871,856, making a total for fourteen years of $646,915,200. According to present estimates the construction for the current year will cost in the neighborhood of $56,000,000, of which the local resources of the companies will supply $25,000,000. A steady improvement of service has been achieved.

The engineering evolution of the telephone which has been accomplished by the engineers, is reviewed. At headquarters the Bell System has a force of 550 engineers and scientists, a staff unequaled in the world, wholly engaged on studies of these subjects.

The report shows that under the pensions, disability benefits and insurance plan, employes had participated in benefits which have aggregated over one million dollars.

REVISION OF BUREAU OF STANDARDS CIRCULAR NO. 32

The Bureau of Standards is preparing a revised edition of its Circular No. 32, "Standard Regulations for Manufactured Gas and Gas Service," to replace the second edition which is now out of print. It is proposed not only to bring up to date the compilation of rules and regulations now in force, but also to make such other changes as may be necessary to correct or improve the Circular. The Bureau will be glad to have suggestions from any one interested in this publication within the next two or three weeks. Comments of this sort should be addressed to the Director, Bureau of Standards, Washington, D. C.

PUBLICATIONS RECEIVED.

Latent Heat of Fusion of Ice. Scientific Paper No. 209, U. S. Bureau of Standards, Washington, D. C.

Accuracy of the Formulas for the Ratio, Regulation and Phase Angle of Transformers. Scientific paper No. 211, U. S. Bureau of Standards, Washington, D. C.

"Rules, Requirements & Universal Safety Standards" is the title of a booklet compiled by Carl M. Hansen, secretary Workmen's Compensation Service Bureau, New York. It contains most valuable data regarding accident prevention.

NEW CATALOGUES.

Yuba Irrigation Pumps (Model D) are described in Catalogue 22 issued by The Yuba Construction Company, San Francisco.

Bulletin No. A4143 issued by the General Electric Company, is devoted to Belt Driven Alternators, known as Form B, and supersedes the company's previous bulletin on this subject.

The Jefferson Glass Company, Follansbee, West Virginia, is distributing a magnificent portfolio among architects, of selected fine art designs. Their application to fixtures of proper design is also illustrated.

The General Electric Company recently issued Bulletin No. A4189, Small Plant Direct Current Three-Wire Switchboards of 125 and 250 volts, and 10 to 100 kw., which supersedes the company's previous bulletin on this subject.

Small Motors, is published monthly by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes some of the applications of the small motors manufactured by this company. No 18 is being distributed.

The Dubilier Electric Company, Inc., 63 Fifth Avenue, New York City, are distributing a loose leaf catalogue, containing descriptive bulletins of resistance units, heating, high frequency, wireless, medical and other apparatus.

"Electric Household Helps," a folder (No. 4197) issued by the Westinghouse Electric and Manufacturing Company, illustrates the use of electric devices in the home, contains a complete price list and shows the watts consumed by each device.

Hospital Signal Systems are fully described in Circular No. 15003 now being distributed by the Holtzer Cabot Electric Company, New York. It covers very thoroughly this company's patients' call system of doctors and nurses and includes the use of an efficiency elapsed time recorder.

An eight page price list, envelope size, is being mailed by the Sprague Electric Works of General Electric Company, New York, to all interested in Portable Ozonators. It is No. 852 and gives a description of a combined ozonator and electric fan in addition to prices and general particulars.

"Westinghouse Portable Meters" (Circular 1104) is the title of a publication just issued by the Westinghouse Electric & Manufacturing Company describing its complete line of portable instruments. A number of detail and complete photographs are shown together with various diagrams.

Catalogue Section DS843 covering catenary line material just issued by the Westinghouse Electric & Manufacturing Company, describes and illustrates with considerable detail the different types of insulators, hangers, strain ears, etc., together with diagrams showing the spacing for wheel trolleys and pantagraph trolleys.

A handy Railway Hand-Book, 1914, leather covered and of vest pocket size is being distributed by the General Electric Company, Schenectady, Pa., which contains a great amount of valuable information, technical and general. It contains information on the Modern Railway Motor, Gearing, Control, Air Brakes, Electric Locomotives, Gas-Electric Motor Cars, The Curtis Steam Turbine, on many other subjects. Many valuable tables and data is included. There is also an atlas and pages for sketch notes.

"Westinghouse Starting, Lighting and Ignition Systems" describes the various electric systems for gasoline automobiles. The different types of generators used for ignition and lighting, and the motors for starting both fly wheel and crank shaft drive, are thoroughly illustrated and described. The single-wire system which has always been advocated by the Westinghouse Electric Company is thoroughly explained and its advantages clearly brought out. The details of wiring, such as switches, sockets, fuses, meters, and batteries are also discussed. The last pages of the book are given to a discussion of the various generators and motors.

INDUSTRIAL

INSTRUMENT POSTS.

Instrument posts are used whenever a device is required upon which to mount meters in a power station in place of using an instrument switchboard. The wiring is concealed in the interior of the posts.

The advantages of instrument posts over panel switchboards are that they permit a very convenient and ornamental mounting for meters, beside locating them in such a position that they can readily be observed without obstructing the general view of the operator.

The usual arrangement is to place these posts so as to form a support for the railing of an operating gallery, each post being placed in front of its respective controlling apparatus which is usually located on a suitable controlling pedestal.

The posts may be secured to the floor either by bolting the shank to the side of channel iron beams located under the floor, or by using a bolted flange collar, secured to the post and provided with holes for holding down bolts. When a concrete floor is provided, a socket can be supplied which may be set into the floor, and which is arranged for bolting to the flange collar.

The standard ornamental posts have plates provided at the places where hand railing is usually attached, but when required hand rail bosses may be substituted. These bosses are drilled to take a standard 2-in. pipe, 2⅜ in. outside diameter. Posts with panel bases cannot be arranged for hand railing.

The standard posts are finished in dead black. The posts having panelled bases are supplied with panels of slate with black marine finish.

Two styles of pedestals are made, with ornamental bases and with panelled bases suitable for mounting control apparatus. Each of these styles is also made with stationary top and with swivel top which can be turned about by means of a hand-wheel just above the base.

These instrument posts are manufactured by the Westinghouse Electric & Manufacturing Company.

NEW AUTOMATIC CONTROLLERS.

For centrifugal pumps and similar machines squirrel cage motors connected directly to 1100 and 2200 volt three-phase systems are used to a considerable extent. The use of motors operating at line distributing voltages is frequently desirable for a number of reasons and for the automatic starting of these high tension motors a new line of self-starters has been designed by The Cutler-Hammer Mfg. Company of Milwaukee. These controllers are of the multiple solenoid type consisting of an angle iron, floor type, self-supporting frame, which carries the high tension oil-immersed solenoid switches and necessary relays controlling the motor and auto-transformer circuits.

The oil-immersed type primary and starting switches used are operated by single-phase solenoids. All contacts are entirely enclosed under oil so that no live parts carrying 1100 or 2200 volts are exposed. Low voltage current is used for the operation of the solenoid coils. The capacities of the standard types of these self-starters range from 20 h.p. to 300 h.p., and are made for both 25 and 60 cycle three-phase circuits. They can be automatically controlled when operating on an open tank system by means of a float switch and on a closed or compression tank system, by means of a gauge or diaphragm pressure regulator. For remote control from one or more points control stations can be employed so that the operator need only to push the button to start or stop the motor.

A ONE-KILOWATT TURBO-GENERATOR LIGHTING UNIT.

Light is frequently wanted for limited areas where steam is available but suitable electric power is not, as on contracting operations, small industrial plants, steam launches, etc. To provide a means for supplying electric light under such circumstances, the Westinghouse Electric & Manufacturing Company has recently put on the market a small turbo-generator which will operate an arc lamp and a few incandescents at the same time, or about forty 25-watt Mazda lamps, or their equivalent alone.

This unit is very compact, being only 3 ft. long and 1½ ft. high, and can be installed anywhere provided the unit is kept horizontal.

The turbine and generator are mounted in the same frame. The turbine is of the impulse type and has a governor which keeps the speed uniform for all variations of load and steam pressure. The full rating of one kilowatt will be developed on 90 pounds steam pressure, and satisfactory operation can be obtained with pressures up to 250 pounds. The weight is 283 pounds. The rated voltage of the generator, 120 volts.

TRADE NOTES.

An order has been secured by the General Electric Company, San Francisco, for two 35 kw. 3600 r.p.m 250/250 volt compound wound Curtis turbine generating sets and one 8-panel switchboard, for installation in the new Hobart building, on Market street.

The Simplex Electric Heating Company, Cambridge, Mass., has become, by invitation, a member of The Rice Leaders of the World Association, founded by Elwood E. Rice. This association is an affiliation of some of the leading business concerns in America. It is an indispensable condition, that any firm, to qualify for membership, must have built its business upon principles of honor, quality, strength and service, all of which are depicted in the emblem to be used by association members in all advertising. It is expected that this association and its propaganda will arouse great interest.

An interesting test of a device for increasing the efficiency of automobile engines has been conducted by Professor Robert Sibley at San Francisco. This device is the Farnsworth economizer, or gas generator, which enables the fuel mixture to be heated by exhaust gases from the engine, and thus allows the use of engine distillate, kerosene or gasoline in operating an automobile. Prony brake tests made on a 40 h.p. 4-cylinder machine showed the following results:

	Gasoline 60.6° B. Without Econ-omizer.	Gasoline 60.6° B. With Econ-omizer.	Distillate 49.8° B. With Econ-omizer.
Gallons of fuel per b.h.p.-hr.	.134	.126	.118
Equivalent travel in miles..	67.2	70.2	70.8
Equivalent speed	22.4	23.4	23.6
Miles per gal, of fuel.....	12.6	15.3	16.8
Cost of fuel per gal.....	14.5c	14.5c	7.5c
Fuel cost per b.h.p.-hr.....	1.943c	1.727c	.885c
Fuel oil per mile.....	1.15c	.94c	.44c

When the device was used the tests showed that the load had to be picked up more slowly than when not in use. Throttle adjustments for speed had to be made very slowly, for fear of stalling the motor, and the response in adjusting the throttle was slow and irregular. In no instance was a carbon deposit found on the exhaust valves, the generator bringing about more complete combustion in the engine cylinder.

NEWS NOTES

INCORPORATIONS.

SEATTLE, WASH.—The Power Plant Equipment Company has been incorporated for $15,000 by F. G. Stafford and Van H. Smith with offices at 810 First avenue, south.

ILLUMINATION.

SPOKANE, WASH.—A number of new arc lights have been ordered by the city commissioner.

POCATELLO, IDAHO.—The cluster light system of Pocatello is to be extended to many side streets.

WELLS, NEV.—Frank Jeanuey has announced that he is preparing to install an electric light plant here.

LODI, CAL.—The Lodi Gas Company is preparing to do considerable work this summer in the way of extensions in Lodi..

NEWPORT BEACH, CAL.—The board of trustees will receive bids up to March 30th for furnishing material and construction of a street lighting system.

RIVERSIDE, CAL.—The recommendations recently made by the Board of Utilities were adopted by the unanimous vote of the councilmen present at the regular meeting held during the past week.

ANACORTES, WASH.—A hearing on an application of the Pacific Northwest Traction Company for a franchise over county roads to build and operate light and power liues, will be heard April 7th. It is the purpose of the company to supply electricity for lighting and power to the LaConner flats and other rural districts.

VENICE, CAL.—The board of trustees has awarded a contract for the installation of street lighting systems as follows: In San Juan avenue from Electric to Ballona avenue, to K. T. Bennett, for $1278; in Brooks avenue from Electric to Ballona avenue, to D. S. McEwan Electric Company, for $2016; in Broadway from Electric to Compton and Santa Monica road, to D. S. McEwan Electric Company, for $2664.

NAPA, CAL.—The Napa Valley Electric Company has filed suit against the Calistoga Electric Company to compel the sale of the latter company's plant to the Napa Valley Company. The concerns are operating in the northern end of this county. The Napa Valley Company claims it has an agreement written with the Calistoga Company by which the latter promised to sell its plant to the Napa Valley concern on demand, and asks the Superior Court to enforce the agreement.

TRANSMISSION.

STRATHMORE, CAL.—The Mt. Whitney Power Company is to erect a substation at this place.

RIVERSIDE, CAL.—The county supervisors have sold to the Coachella Valley Ice & Electric Company the franchise to run electric power lines from Banning through the Coachella valley to the eastern county line.

ALPINE, TEX.—The plant of the Alpine Power Company has been sold to Geo. Miller, Jackson and Harmon, and J. W. Weaver, by J. P. Wilson, trustees. The plant is to be remodeled and service improved and extended.

REDONDO BEACH, CAL.—The Pacific Light & Power Company has received a building permit for a reinforced concrete building to be erected on its lots in Ocean Beach subdivision, to be used as an addition to its power plants.

GREENVILLE, CAL.—The Great Western Power Company is considering the application of owners of quartz mining interests in the Indian Valley section that the company run a power line from the power plant below Butte Valley into the heart of the quartz belt.

HUNTINGTON BEACH, CAL.—The Pacific Light & Power Company which has constructed the Big Cheek power stations, has finished its transmission lines into this city and has been granted a franchise by the city council for light and power distribution. An application has been made to the State Railway Commission by the Huntington Beach Light & Power Company for authority to sell its distributing system to the Pacific Company. The petitioner asks $21,691 for its properties.

PORTLAND, ORE.—Geo. H. Cecil, U. S. District Forester, has issued a special use permit to the Golden Gate Mining Company, an Arizona corporation, developing mines in the Whitman national forest in the Blue Mountains of Eastern Oregon, to erect a power house, conduit and auxiliary improvements for the generation and transmission of electric power. The company expects to begin work this summer. The power will be used to operate the mines. The power house will be 6 miles from Greenhorn, and 500 h.p. will be developed. A quarter acre reservoir and conduit 4000 ft. long will be installed at an estimated cost of $25,000.

SAN FRANCISCO, CAL.—The department of electricity has filed with the supervisors a statement of the allowance required for next year, amounting to $404,161, approximately four times as much as its appropriation for the present fiscal year, $103,146. It proposes to increase salaries and to enlarge its force of employes as well as to reconstruct the fire and police alarm and signal system. The department asks $4550 for motor cars and other transportation needs, $52,000 for extensions and equipment, $17,000 for general maintenance, $71,621 for new construction, $134,582 for reconstructing the present fire alarm system and $25,000 for new machine shops and yards.

LOS ANGELES, CAL.—The $6,500,000 power bond election will be held May 5th. The ordinance, setting the date and naming the election officers, is now being prepared and will be ready for presentation in a few days. It was also announced that only voters who have registered since January 1st can vote on the power bonds. Opposition to the decision of the council to submit the $6,500,000 project in one issue, and not segregate them into development and distribution, has already developed. Opponents to the single bond issue proposition want the bonds segregated, one issue of $1,250,000 for development of the power projects, and the remainder for distribution of power.

PLACERVILLE, CAL.—To carry out the conditions of the forest service in construction of power plants the Truckee River General Electric Company will probably commence work this summer. The construction work will give employment to many men and make the Georgetown divide a busy section until the electric project is completed. On February 24th approximately 200 acres of land within El Dorado county were withdrawn from entry and designated as power site reserve No. 432, Gerle Creek. This land is embraced within the proposed Gerle Creek and the Rubicon reservoir, parts of the water project of the Truckee River General Electric Company, to which a permit was issued by the forest service September 8, 1913. The stipulations of the permit require the company to commence work within 12 months on unit No. 1 of the project, consisting of several reservoirs and ditches and two power plants known as plants located on Pilot Creek, El Dorado county. That part of the project must be completed and ready for operation in four years of the date of the issuance of the permit.

TRANSPORTATION.

PARKER, ARIZ.—Redmund Toohey, a Phoenix railroad contractor, and W. H. Tharpe, promoter of the new electric railway for Parker valley, recently went over the route of the proposed line and active work is expected to begin soon.

SAN BERNARDINO, CAL.—Rumors are afloat here to the effect that the Pacific Electric Railway Company contemplates in the near future the construction of an electric railway to the crest of the San Bernardino mountains for a sight-seeing line.

OAKLAND, CAL.—A permit for the San Francisco-Oakland Terminal Railways has been asked by San Lorenzo residents, that the company extend its San Lorenzo line to San Lorenzo Grove. The company expressed its willingness to broad gauge and improve the branch road and make extensions which would be about two blocks in length.

SAN FRANCISCO, CAL.—An electric railway from San Francisco to Palo Alto, equipped to meet all the requirements of Peninsula commuters will be built at once if the San Mateo County Development Board procures the right of way. This is the declaration of Fred A. Stokes, who put the project before the executive committee of the San Mateo board, and who says that he can furnish the necessary funds on the day the right of way problem is solved.

SAN FRANCISCO, CAL.—Bids received for the construction of the Van Ness avenue and Chestnut street extensions to the municipal street railway system resulted in a close contest between R. C. Story and Mahoney Bros., the later being the lowest by $192 in work aggregating almost a quarter of a million dollars. The bids were: Healy-Tibbetts Construction Company, $290,800; F. Rolandi, $235,852; R. C. Story, $219,940; Mahoney Bros., $219,747. The city engineer's estimate for the work, including a possible bonus, was $240,000.

SAN JOSE, CAL.—An effort to revive the San Jose Terminal Railway project, a proposed line between this city and Alviso, was made at a recent meeting of the mayor and common council, when Judge F. G. Brown of San Francisco and E. M. Landis of the Tidewater Southern electric road in the San Joaquin Valley, submitted two ordinances which were given first reading. Judge Brown in addressing the council referred to the loss of terminal rates by this city and stated that the proposed line to Alviso might be the means of solving the question of cheap freight rates.

MANILA, P. I.—The Manila Railroad & Electric Light Company is planning to extend its electric railway and electric power company into some of the nearby Provinces of Luzon. T. W. Swift, president of the company, visited Manila to look over the situation. The extensions of the present lines are said to include a line to the town of Paranaque, a further extension of the Malabon line to Obando, and electric lighting lines to near-by towns. The basin of the Angat River will be made the site of the hydroelectric plant the company is planning to install to furnish power.

SALT LAKE CITY, UTAH.—Plans for the floating of bonds amounting to $2,000,000, the proceeds to be used in construction are being made by local interurban lines. The Salt Lake Terminal Railway, a consolidation of the Bamberger road and the Salt Lake & Utah, will benefit in the erection of an uptown terminal. The line of the Salt Lake & Utah, extending from Provo to Payson and southward, will also be constructed from the proceeds. The Salt Lake & Utah, known as the Orem road, has only recently completed its track from Salt Lake City to American Fork and is now at work on the stretch between American Fork and Provo. An issue of $1,000,000 will be floated for the extension to Payson. The other issue of $1,000,000 will be made for the Salt Lake Terminal Company, the money going for shops, yards, tracks, car barns and an up-to-date passenger station.

TELEPHONE AND TELEGRAPH.

SUSANVILLE, CAL.—The people of Willow Creek Valley are planning for the construction of a mutual telephone line from Grasshopper Valley to this city. It will be connected with the Dry Valley and Madeline line.

CENTRALIA, WASH.—The board of county commissioners have granted a franchise to the Bunker Creek Telephone Company and Mary E. Coffman for a telephone line along Bunker Creek and to the Crego Telephone Company for a line into Crego district.

LOS ANGELES, CAL.—Extensive telephone extensions are to be made in the near future in the southeastern part of the city, especially in Walnut Park district. A. B. Cass, president of the Home Telephone & Telegraph Company, states that about $50,000 worth of supplies have been ordered for the work.

WATERWORKS.

SAN FRANCISCO, CAL.—The Board of Public Works has awarded to Scott & Company the contract for installing a water supply system in the new city hall for $13,475.

MILTON, ORE.—To secure money with which to improve the Milton city water supply and to extend and improve the electric light system, the voters of this city will be called upon shortly to authorize an $18,000 bond.

ROUNDUP, MONT.—The $60,000 city waterworks bond issue was sold at public auction in the council chambers of the city. The bonds were bought by the Continental Trust & Savings Bank of Chicago for $62,650 and accrued interest.

CHELAN, WASH.—H. S. Green of the engineering firm of H. S. Green & Company, of Spokane, was here recently in conference with city officials relative to the installing of municipal water plants in the town and in Lakeside.

RATON, N. M.—Hiram Phillips, consulting engineer, and J. B. Gordon, who holds the contract for the construction of the new Raton waterworks, has arrived from Pueblo and states that construction work on the new plant will begin soon.

PENDLETON, ORE.—Signed by 300 voters the initiative petition asking for a special election at which to vote upon a $40,000 bond issue for the completion of the gravity system was presented to the city council. It was referred to a special committee.

OAKLAND, CAL.—An ordinance is being considered by the city council for the appropriation of $30,000 for the extension of the high power salt-pumping station at Fourteenth and Oak streets south on Oak to First and from Oak street on Eighth west to Franklin.

SALEM, ORE.—Frank Bishop of Goble, has filed with State Engineer Lewis an application for a permit to appropriate the waters of a branch of Goble Creek for a municipal supply. Mr. Bishop proposes to extend the present pipe line supplying the city of Goble about two miles further up the stream, and tap a branch in Goble Creek.

HOQUIAM, WASH.—Plans of the city commission to take definite action towards the establishment of a municipal water system developed at a meeting when a resolution outlining the plan was read and laid over for one week. The resolution states the future welfare of the city requires a system of waterworks for an ample supply of water for all purposes.

SAN RAFAEL, CAL.—A right of way through the White Hill tunnel in Marin county of the Northwestern Pacific Company for a water pipe line has been secured by Harvey M. Toy and a group of capitalists, who are organizing a water company which, it is reported, is to supply water to residents of San Rafael, Ross and San Anselmo. Toy has a right of way of four feet on the side of the track for the pipe. His company expects to get its water from the mountains surrounding the San Geronimo Valley, and to supply Lagunitas, Woodacre and San Geronimo with water.

ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page opposite

A-1 American Ever-Ready Co.....
Los Angeles; 755 Folsom Street, San Francisco; Seattle.

B-1 Benjamin Electric Manufacturing Co.....
Rialto Building, San Francisco.

B-2 Berkeley Electric Cooker Co.....
1932 Center Street, Berkeley.

B-3 Blake Signal and Manufacturing Co.....
680 Howard Street, San Francisco.

B-5 Bridgeport Brass Co.....16
(See Pierson, Roeding & Co.)

C-1 Century Electric Co.....4
614 So. Grand Ave., Los Angeles; Salt Lake City; 56 Natoma Street, San Francisco; Seattle; Spokane.

C-2 Crocker-Wheeler Co.....12
Title Insurance Bldg., Los Angeles; Salt Lake City; First National Bank Bldg., San Francisco; Seattle.

C-3 Cutler-Hammer Manufacturing Co.....15
579 Howard Street, San Francisco; Morgan Bldg., Portland, Ore.; San Fernando Bldg., Los Angeles.

D-1 D. & W. Fuse Co.....
(All Jobbers.)

D-2 Dearborn Drug and Chemical Works 12
355 East Second Street, Los Angeles; 301 Front Street, San Francisco.

E-1 Edison Lamp Works of General Electric Co.....15
(See General Electric Company.)

E-2 Edison Storage Battery Supply Co.....12
441 Golden Gate Avenue, San Francisco.

E-3 Electric Agencies Co.....
247 Minna Street, San Francisco.

E-4 Electric Storage Battery Co.....
Pacific Electric Building, Los Angeles; Spalding Building, Portland; 118 New Montgomery Street, San Francisco; Colman Building, Seattle; Pacific Building, Vancouver.

F-1 Fairbanks, Morse & Co.....
Los Angeles; Portland; 651 Mission Street, San Francisco; Seattle; Spokane.

F-2 Fort Wayne Electric Works of G. E. Co.....
Rialto Building, San Francisco; Colman Building, Seattle.

G-1 General Electric Co..... 14
124 W. Fourth Street, Los Angeles; Worcester Building, Portland; Rialto Building, San Francisco; Colman Building, Seattle; Paulsen Building, Spokane.

H-1 Habirshaw Wire Co.....
(See Western Electric Company.)

H-2 Hemingray Glass Co.....12
330 So. L. A. Street, Los Angeles; 345 Oak Street, Portland; 807 Mission Street, San Francisco.

H-3 Hoagland-Hulse Electric Co.....
1707 Naud Street, Los Angeles.

H-4 Hunt, Mirk & Co.....
141 Second Street, San Francisco.

I-1 Indiana Rubber and Insulated Wire Co.....16
807 Mission Street, San Francisco.

K-1 Kellogg Switchboard and Supply Co.....
Aronson Building, San Francisco.

K-2 Keystone Boiler Works.....
201 Folsom Street, San Francisco

K-3 Klein & Sons, Mathias.....12
579 Howard Street, San Francisco.

K-4 K-P-F Electric Co..... 3
37 Stevenson Street, San Francisco.

L-1 Leaby Manufacturing Co.....12
Eighth and Alameda Streets, Los Angeles.

L-2 Locke Insulator Manufacturing Co..... 4
(See Pierson, Roeding & Co.)

M-1 Mannesmannrohren-Werke .....
Rialto Building, San Francisco.

M-2 McGlauflin Manufacturing Co.....12
Sunnyvale.

M-3 Moore & Co., Charles C..... 5
Van Nuys Building, Los Angeles; Spalding Building, Portland; Kearns Building, Salt Lake City; 40 First Street, San Francisco; Mutual Life Building, Seattle; Santa Rita Hotel Building, Tucson.

M-4 Morse Chain Co.....
Monadnock Bldg., San Francisco.

N-1 Nason & Co., R. N.....
151 Potrero Avenue, San Francisco.

N-2 National Conduit & Cable Co., The.....
Trust and Savings Building, Los Angeles; Rialto Building, San Francisco.

N-3 National Lamp Works of G. E. Co.....
(All Jobbers.)

N-4 New York Insulated Wire Co.....
629 Howard Street, San Francisco.

N-5 Norris Co., L. A. .....
Monadnock Building, San Francisco.

O-1 Okonite Co. 16
(All Jobbers.)

P-1 Pacific Electric Manufacturing Co.....
80 Tehama Street, San Francisco.

P-2 Pacific States Electric Co..... 2
526 So. L. A. Street, Los Angeles; 90 Seventh Street, Portland; 526 Thirteenth Street, Oakland; 575 Mission Street, San Francisco; 307 First Ave., So., Seattle.

P-3 Parker Boiler Co.....
201 Folsom Street, San Francisco.

P-4 Pelton Water Wheel Co.....12
2219 Harrison Street, San Francisco.

P-5 Pierson, Roeding & Co..... .. 3-4-16
Pacific Electric Building, Los Angeles; Spalding Building, Portland; Rialto Building, San Francisco; Colman Building, Seattle; Pacific Building, Vancouver.

P-7 Pittsburg Piping & Equipment Co.....16
Monadnock Building, San Francisco.

S-1 Schaw-Batcher Company, Pipe Works, The.....
211 J Street, Sacramento; 356 Market Street, San Francisco.

S-2 Simonds Machinery Co.....
12 Natoma Street, San Francisco.

S-3 Simplex Electric Heating Co..... 4
612 Howard Street, San Francisco.

S-4 Southern Pacific Co..... 4
Flood Building, San Francisco.

S-5 Sprague Electric Works of G. E. Co..... 4
Rialto Building, San Francisco; Colman Building, Seattle.

S-6 Standard Underground Cable Co.....
First National Bank Bldg., San Francisco; Hibernian Bldg., Los Angeles; Yeon Bldg., Portland, Or.; Central Bldg., Seattle, Wash.

S-7 Staples & Pfeiffer.....
102 Steuart Street, San Francisco.

T-1 Thomas & Co., R.....
(See Western Electric Co.)

V-1 Van Emon Elevator Co.....
56 Natoma Street, San Francisco.

W-1 Wagner Electric Manufacturing Co..... 3
Rialto Building, San Francisco.

W-2 Western Electric Co.....
119 East Seventh Street, Los Angeles; 507 Sixteenth Street, Oakland; 680 Folsom Street, San Francisco; 1518 First Avenue, So., Seattle.

W-3 Westinghouse-Church-Kerr Co.....
Pacific Electric Building, Los Angeles; Pacific Building, San Francisco.

W-4 Westinghouse Electric and Manufacturing Co..... 6
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VOL. XXXII NO. 14 SAN FRANCISCO, APRIL 4, 1914 PER COPY, 25 CENTS

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BY H. A. RUSSELL.

NOTES OF RECENT CALIFORNIA CASES ON WATER RIGHTS.
BY A. E. CHANDLER.

LEGAL REQUIREMENTS FOR OVERHEAD CONSTRUCTION IN CALIFORNIA.
BY J. E. MACDONALD.

DETAILS OF A UNIQUE LIGHTING SCHEME.

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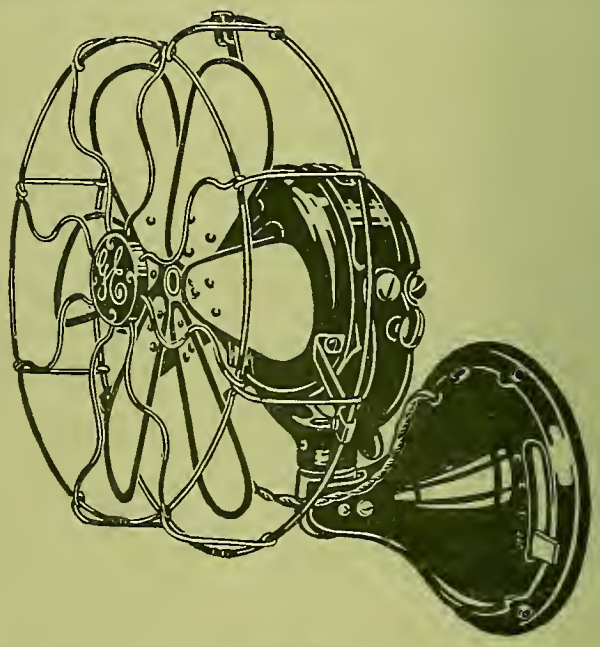
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VOLUME XXXII SAN FRANCISCO, APRIL 4, 1914 NUMBER 14

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A LOG OF THE "JUPITER'S" TRIAL TRIP

BY H. A. RUSSELL.

The first trial trip of the U. S. Collier "Jupiter" was started on November 14th, a Friday. The weather was propitious and great was the disappointment when soon after starting something went wrong with the turbine. A tap bolt had broken off in the first stage of the turbine making a rattling noise and inspection showed that the first stage buckets had become badly bent. These buckets could have been straightened with very little trouble after the bolt was removed but it was decided to put in a new set of buckets before attempting the official trial. The buckets were accordingly made at the factory and afterwards put in place while the vessel was lying at Mare Island.

The second official trip was started on Saturday, February 14th, escaping both Friday and the 13th this time, and after the heavy storms that had prevailed it seemed as though all concerned would be amply repaid for their enforced waiting.

The "Jupiter" is a twin screw ship of the single deck type, designed for a speed of 14 knots, and developing 5500 shaft horsepower.

The principal dimensions are:

Length over all	542 ft. 2½ in.
Extreme beam	65 ft. 2 13/16 in.
Mean draught	27 ft. 6 in.
Displacement	19,230 tons.

The cargo capacity is 966,265 gal. of oil and 9856 tons of coal, or 405,617 gal. of oil and 11,377 tons of coal, this making her burden about 12,000 tons.

The propelling machinery consists of one turbo-generator and two induction motors direct connected to the shaft of each propeller. The normal rating is as follows:



Electrically Propelled Collier U. S. S. "Jupiter."

Generator—		Motor—	
Kilowatts	5450	Number of poles	36
Number of poles	2	Horsepower	2750
Number of volts	2300	Volts	2300
Revolutions	1990	Revolutions	110
Excitation in amperes	250		

The motors are coil wound, having collector rings for introducing resistance into the rotor winding.

A set running speed is maintained through the turbine by fixing the governor for any predetermined speed. For manoeuvering or coming to a dock this speed may again be varied by varying the resistance

in the rotors of the motors. The weight of the electrical machinery, including turbo-generator, motors, exciters and switchboard, is 156 tons.

The "Jupiter" cost a little over a million and a quarter dollars. The ship is under the Navy and has a complement of 11 officers and 148 men.

The present officers are:

J. M. Reeves, Commander, a genial host and an officer of whom our Navy may well be proud.

S. M. Robinson, Chief Engineer and Executive Officer Lt., who has made a study of turbine drive.

Wm. P. Gaddis, Navigation Officer, who can put a pencil on a chart at any time of the day or night which would locate the ship's position.

L. S. Whiteside, Surgeon, always looking out for the health of the crew but not overburdened on this trip.

J. A. Harmon, Paymaster, who looked after the mess and was a busier man than the doctor.

N. L. Kirk, M. Hodson, F. Hindrelet, Ensigns, who stood watch.

E. L. Kempton, Chief carpenter.

R. L. Scott, Chief machinist.

W. T. Shaw, Boatswain.



Com. J. M. Reeves



Left to right: Chf. Eng. S. M. Robinson. W. L. Emmet. Lieut.Com. G.S. Lincoln.

The Chief of the Trial Board was Captain C. A. Grove of Yerba Buena, and with him were Commander J. R. Brady, Bremerton; Lt. Commander L. S. Shapley, Mare Island; Lt. W. A. Smead, Mare Island; Naval Constructor R. B. Hilliard of Vicksburg.

Representatives of the Mare Island Navy Yard were: Naval Constructor H. M. Gleason; Lt. R. L. Stover; and Assistant H. O. Shuster.

Also assisting on the Trial Board were: Lt. J. J. Manning; Lt. R. T. Kieren; Ensign J. D. Moore; Chief Machinists C. M. Huber and A. Peterson.



Chf. Mchst. R. L. Scott

The Navy Department invited a limited number of guests who were interested in the operation of the boat, consisting of W. H. Bailey, W. J. Davis Jr., F. E. Vickers, H. A. Russell of the General Electric Company; H. B. Truett, Kern Trading & Oil Company; C. V. Lane, Union Iron Works; J. N. Densham, H. Forsland, R. W. Walker, representatives of the press; R. B. Beal, of the Federal Telegraph Company; A. H. Babcock and F. G. Geibel, of the Southern Pacific Company; J. F. Donahue, of the Meade Morrison Mfg. Company, who installed the coal handling gear; J. P. Van Leer, of the Standard Oil Company.



Trial Board.
Reading left to right: Lieut. Com. L. S. Shapley; Com. J. R. Brady; Capt. C. A. Grove; Lieut. W. A. Smead; and (seated) Navy Const. R. B. Hilliard.

We cast off from the Coaling Station at California City at 12:00 o'clock and with a smooth sea and light easterly breeze passed the Lightship at 2:20. The official run of 48 hr. at full speed was commenced at 3:00 o'clock, taking a southwesterly course for about 350 miles to sea.

The ship's performance was determined from many angles and all observations checked against each other. All the coal was weighed. All the water returned from the condenser was weighed and measured in tanks before being pumped back into the boilers for feed water. All electrical output was measured by instruments on the switchboard. Revolutions of the generator and motors, which are direct connected to the propellers, were taken by electrical and mechanical speed counters. The actual horsepower given to propellers was measured on the shaft by torsion meters. All readings were taken and recorded hourly and more often where deemed necessary.

After our course had been set the handling of the boat became mere routine and there was nothing left to do except to take readings and await results.

The boat was designed for a propeller speed of 110 revolutions to give 14 knots per hr. From former performances and ship tests we estimated that the 48 hr. run would show about 15 knots, it would all depend upon keeping up steam pressure, barring accidents which nobody anticipated. All day Saturday there was a smooth sea with a light breeze and a sunny sky. Sunday morning opened cloudy and with light rain and little prospect of the Navigating Officer having a sight of the sun. In fact, cigars were bet that we would not be able to take an observation before noon, but Mr. Gaddis won handily, and the day turned out bright and sunny enough to so entitle him to three cigars. At 1:45 p. m. Sunday, the 15th, we reached our most westerly point, some 300 miles to sea, and put about setting our course for Point Conception, or a little north of it. Monday morning about 10:00 o'clock land was sighted which proved to be Point Arguello. We were about 70 miles off at the time and being an overcast day and, probably, as we thought foggy about the coast, a remarkable pick up. At 2:40 in the afternoon we came abreast of Point Conception, changing our course in the Santa Barbara channel, which we kept until the completion of our 48 hr. run which ended at 3:00 o'clock. We then steamed to anchoring ground off Santa Barbara where we lay for the night.

Tuesday, the 17th, was devoted to standardizing. This consists of running over a standard mile which is measured by ranges on the beach and noting the data attending each run. Five of these runs were made, three in one direction and two in the opposite to determine data at full speed which proved to be about 15 knots per hr. Three mile runs were made to determine data at 14, 12, 10 and 8 knots, respectively, making seventeen trips over the course in all.

After this the turning test was made. When going at full speed a float was put overboard and at the same time the wheel put hard over. When a circumference of 180 degrees had been described a second float was put over and the course of the two floats observed. The ship was then brought past the two floats at full speed and the time noted which enabled the observers to calculate the distance between the two floats or the turning diameter. The boat took two minutes to complete 180 degrees and the turning diameter was about 800 yds. The data given by this test proved the ship better in manœuvering than some of the officers had expected. The 48 hr. run had been completed at full speed and the total consumption of fuel and water noted.

While anchored at Santa Barbara a four hour run was made to determine the steam consumption of all auxiliaries. This run was made under conditions identical to those in the 48 hr. run. Deducting the steam taken by auxiliaries from the total steam gave us the steam consumed by the turbine. The standardizing runs have now been made giving the speeds attained under different revolutions of the propellers.

One more test remains and that is the endurance test of 24 hr. at a 10 knot speed. This test was started Tuesday night at 8:15. At this time our course was again set to sea to avoid coastwise vessels and possible fogs, it also being desirable not to approach too near the coast before daylight. Tuesday night and throughout Wednesday was cloudy and threatening, thunder storms off the coast could be noticed by distant lightning flashes. Wednesday night we experienced a southeaster, probably the tail of the storm that did so much damage to the railroads and highways in southern California. Our cots were made down in the ward room and, while the chairs were lashed to tables and posts, the cots were free to visit where they listed and when the ship listed, which was often. It was reported that the vessel rolled nearly 30 degrees on both sides and this does not seem unreasonable when one stops to consider the weight of superstructure in the coal handling gear. Looking at it from the bridge it looks like a forest of steel booms. Our 24 hr. run finished at 8:15, 100 miles south of the Farallones.

At 8:15 Thursday morning we dropped anchor off California City after which another four hour run to determine the water rate of auxiliaries completed the 24 hr. or 10 knot test. This completed the test with the exception of the coal handling gear which was made while at anchor off California City.

It may be interesting to note how the manufacturer's expectations have been realized and to make a comparison between the operation of a boat of this character and one equipped with the well known type of reciprocating engine. One important point is the accurate data which was obtained and which cannot be had with the ordinary engine. The amount of electrical power being developed may be read by the electrical instruments at any instant. The losses of the generator and the motors are definitely known from shop tests so that we know the exact amount of power going into the propelling shafts. The total electric losses are 8 per cent, being about 3 per cent in the generator and 5 per cent in the motors. This again is checked by the torsion meter and all of these results checked within practical limits.

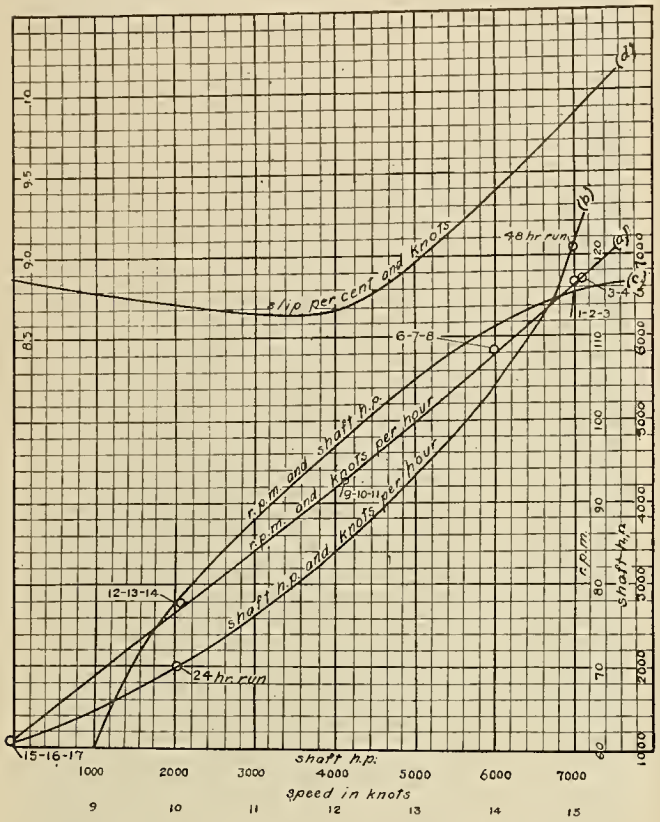
Preliminary tests were made before the accident to the turbine which occurred in November, and after putting in a new row of buckets the first tests were verified, showing that the results in the turbine are



A Forest of Steel Booms.

not obtained by any haphazard methods. The manufacturer designed the turbine to give an expected water rate of 11.2 lb. per shaft h.p. This result was obtained in shop tests after the turbine was built. This water rate was calculated under dry steam at 190 lb. pressure at the throttle and 28½ in. vacuum. While these exact conditions could not be met on the 48 hr. run corrections to allow for different conditions would bring the water rate to the manufacturer's original estimate within a very close margin. The manufacturer's guarantee was 13 lb. of water per indicated horsepower at full speed, or at 14 knots. It will be seen that expectations were more than realized both in water rate and speed. There is no doubt that with oil burning boilers better results would have been obtained. The real hard work was done in the fire room to keep up steam, while with oil the pressure could have been maintained at a given point about as easily as we set the turbine governor for a given speed. The revolutions of the propeller necessary to attain

the different speeds show a very efficient propeller. This may be due entirely to the design of the propeller or, as has been suggested, it may be that the uniform rotation of the propellers allows them to work up to a higher efficiency. One thing, however, worthy of notice is that with a motor drive we can choose the most efficient speed of propeller and then build the motors to suit. The sister ships to the "Jupiter" are the "Cyclops" and "Neptune," the former propeller speed being 88 revolutions and the latter 135. The

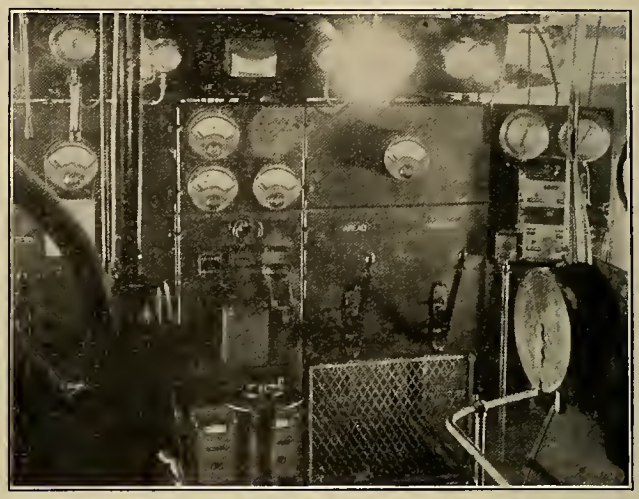


Curve "a" which is nearly a straight line, is an important one for operating the ship. The Navigator calls for 10, 12 or 14 knots per hr., and from this curve the engineer can set the governor for the number of revolutions to give the required speed.

Curves "b" and "c" give the horsepower under different speed from which the water rate can be calculated.

Curve "e" shows the slip of the propeller which does not show great change of efficiency at the different speeds. The most efficient point of propeller is 11.6 knots, the slip being 8.66 per cent. At 10 knots and 14 knots it is respectively 8.73 and 9.4 per cent, the difference being a little over one-half of one per cent.

Jupiter's propeller speed is 110, which from the results obtained would make it appear to be better design. The "Cyclops" and "Neptune" propeller speeds are the speeds best suited to their prime mover but in a motor drive the speed is immaterial so long as it is right for the propeller. At all events, the speed is under control at all times, an important item in a battle ship where speed regulation is relied upon to keep formation. The turbine maintains uniform speed, and likewise the motors, no matter whether the propellers are submerged or partly out of water. The governor may be set for any predetermined speed by the turn of a handwheel. The man on the bridge calls for 8, 10 or 15 knots, the governor is set for this speed and nothing more is to be done, and the speed called for is maintained until another speed is wanted. There is no disagreeable vibration from the propeller and while the ship the last day out was rolling its heaviest and cots were sliding about the ward room one could not tell that the ship was under way from its motion. The only evidence of moving machinery was the throbbing of the dry air pump which we might call the lungs of the system. This reciprocating machine could well be replaced with a rotary one which would still allow the ship to breathe without snoring.

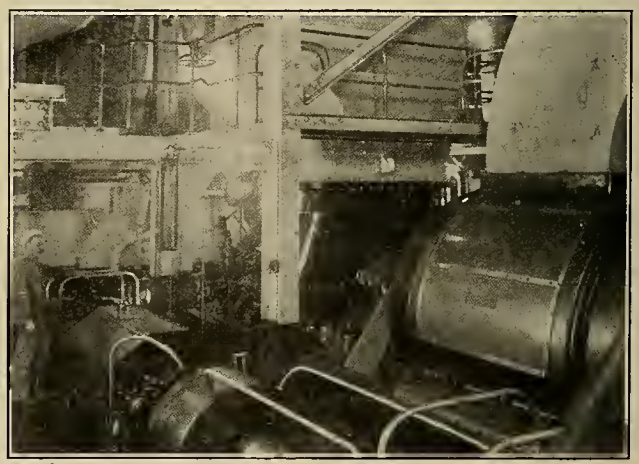


Switchboard U. S. S. "Jupiter."

On an official trial everything is keyed up and nursed to get the most favorable results. Here the engine room routine was carried on as on an ordinary cruise except for the frequent readings of instruments. No bearings were opened or the many guides, valves and pins nursed along as in other trial trips—for there were none. When the ship was tied up at California City there were no repairs to be made and she could have turned around for a long sea voyage the next day if necessary.

The turbine on land has come to stay and its advantages are equally important, or more so, and quite as available at sea.

The principle of the turbine is not new and what has held back its development the most has been the



Turbine and Generator.

lack of a suitable application of its high speed until the advent of the dynamo. It has been asked why ship owners have not already taken advantage of the economy and reliability possessed by the turbine. It is because a suitable means of speed reduction has not

been thought out until quite recently. The turbine builders have been too busy ashore to go to sea. A high speed turbine can be hitched up to the low speed propeller by means of motors or by gearing designed for the purpose. Different conditions may make one or the other desirable but the turbine is back of either of them.

The results obtained in the trial are as follows:

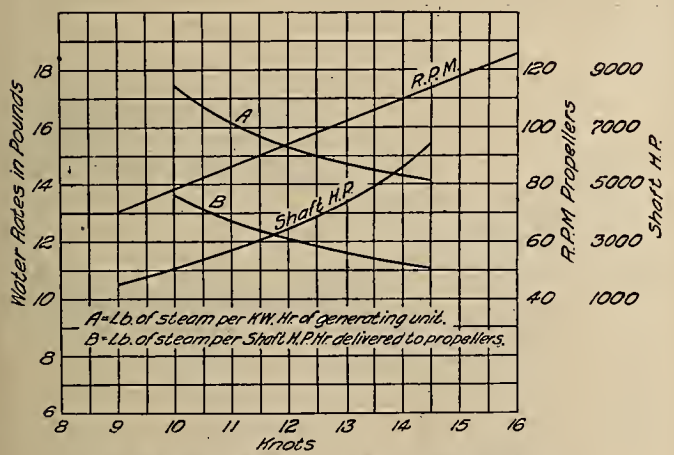
48 Hr. Run—Maximum Attainable Speed.

	Trial Runs.	Contract Guarantees.
Average sustained speed, knots per hr.	14,996	14
Shaft h.p.	7,152	5,500
Shaft r.p.m.	116.7	110
Lb. steam per shaft h.p.	11.69	13
Lb. coal per shaft h.p.	1.662	..

24 Hr. Run—10 Knots per Hr.

	Trial Runs.	Contract Guarantees.
Lb. Steam per shaft h.p.	12.31	15
Shaft h.p.	2,157	..
Shaft r.p.m.	76.8	..
Lb. coal per shaft h.p.	2,505	..
Steam pressure, pounds	165	190
Vacuum, 30-in. bar	28.5	28.5
Moisture in steam (per cent)	1½	Dry

It will be seen that conditions during the trials were not up to standard named in manufacturer's contract, the steam pressure at the turbine throttle being 165 as against 190 lb. Also there was about 1½ per cent moisture in the steam which should have been delivered dry to the turbine. Correcting the water



Water Rates U. S. S. "Jupiter"—Conditions, 190 lb. Gauge, 28.5 in. Vacuum, No Superheat.

rate by 3 per cent to allow for 1½ per cent moisture and 2½ per cent for the difference of 25 lb. steam, brings the water rate during the 48 hr. run at maximum speed down to 11.04 lb. which agrees very closely with the factory test of 11.2. Similarly, the water rate for the 24 hr. run at 10 knots should be corrected to 11.63, which also agrees very closely with the factory test. The drop in steam pressure is due to the 8 in. steam pipe between boilers and turbine—this is being replaced by 12 in. pipe which will show a marked improvement in results. The curve herewith shows the revolutions and horsepower developed at different speeds.

Considering these results with the data thus far obtained from the "Cyclops," the "Jupiter's" economy is 20 per cent better with a weight of 156 as against 280 tons. The weight and economy are a marked advantage in a marine installation that counts for a good deal more than it would on land. As the turbine has replaced the engine on land there are more potent reasons why it should do the same thing at sea.

LEGAL REQUIREMENTS FOR OVERHEAD CONSTRUCTION IN CALIFORNIA.

BY J. E. MACDONALD.

These notes and diagrams were prepared, primarily, for guidance of those in charge of various distribution systems in Southern California. Chapter 499, Statutes of California, 1911, of itself supplies sufficient verbosity to preclude any lengthy apology for presenting them for publication in an attempt to assist others in "upholding the majesty of the law." These regulations have been in effect for a period of over two years and it is still not unusual to be called upon to elucidate such clauses as: "and further provided, that the provisions of this paragraph (b) shall not be held to apply to telephone, telegraph or other "signal" wires or cables on poles to which are attached no other wires, as between such wires and poles to which are attached no other wires or cables than telephone, telegraph or other "signal" wires; provided, such wires, cables and poles are not within the corporate limits of any town or city which shall have been incorporated as a municipality."

There may be some reasonable excuse for diversity of opinion as to the interpretation of such statements. It is not maintained that these notes contain all that is implied in the statute, but the analysis is simply a brief exposition of what many engineers have agreed to be the intent and purpose of those responsible for this legal enactment.

Regulations Required by Chapter 499, Statutes of California, 1911.

(The legal minimum herein shall not be understood as prohibiting the adoption of greater clearance where necessary.)

Section 1.

(a) Minimum clearance from center of pole—thirteen inches for wires and cables. (See Fig. 1.)

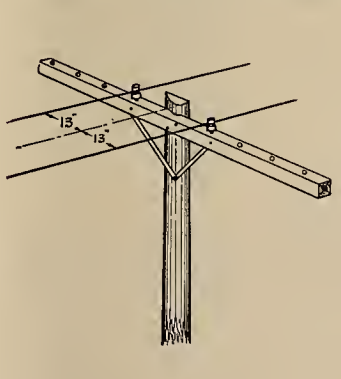


Fig. 1.

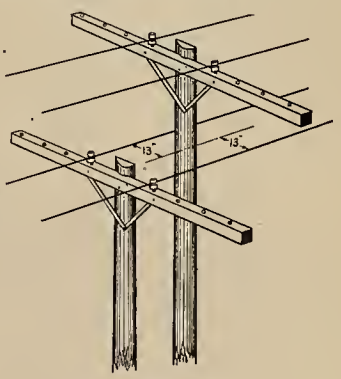


Fig. 2.

Exceptions allowed by law:

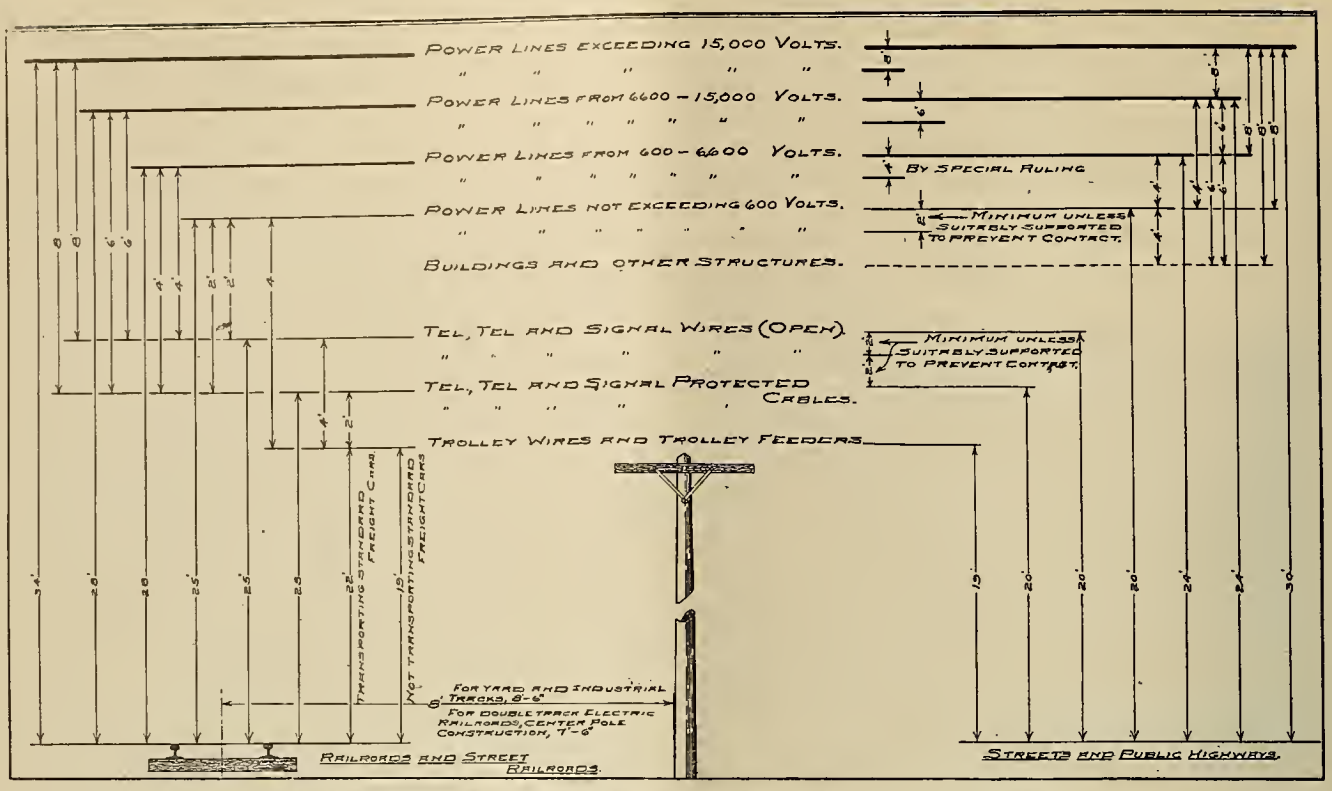
1. Telegraph, telephone and signal wires or cables outside incorporated municipalities where no light or power wires are maintained on same pole.

2. Wires or cables run from underground and placed vertically on pole.

3. Bridle or jumper wires from telegraph, telephone and signal wires or cables.

4. Aerial cable terminals and wires continuing from same where no light or power wires are attached to poles in same location or on same side of street.

5. Wires run from lead wires to arc lamps or transformers.



Clearances for Wire Crossings Required by California Railroad Commission.

6. Wires or cables attached to top of pole.

Note:—For other exceptions see Section 2.

(b) Minimum clearance from center of pole—thirteen inches for wires and cables. (See Fig. 2.)

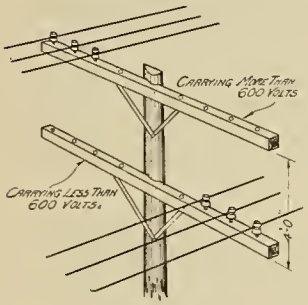


Fig. 3.

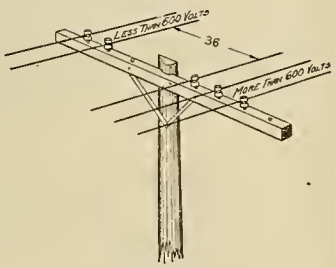


Fig. 4.

Exception allowed by law:

1. Telegraph, telephone and signal wires or cables outside incorporated municipalities where no light or power wires are maintained on same pole or other poles in same line.

(c) Minimum vertical clearance between crossarms carrying more than 600 volts and crossarms carrying less than 600 volts—four feet. (See Fig. 3.)

Exceptions allowed by law:

1. Wires or cables attached to transformers.
2. Wires or cables within buildings or structures.
3. Wires and cables run from underground and placed vertically on poles.
4. Lead wires and cables.
5. One crossarm only, used for light and power distribution. (See Fig. 4.)
6. Alternative clearances, for combination construction for light and power lines. (See Fig. 5.)

Note:—It has been found that the reduced clearances for combination construction are not practica-



Fig. 6.

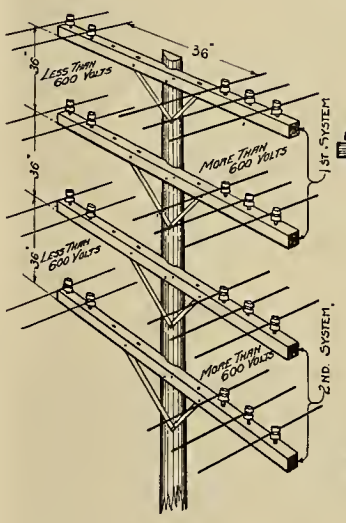


Fig. 5.

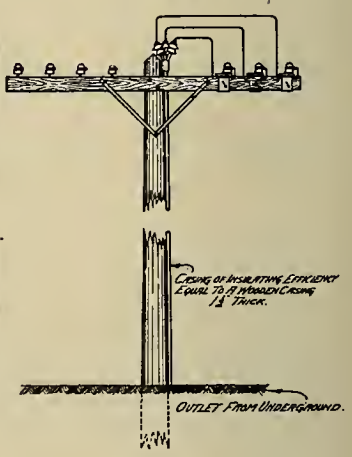


Fig. 8.

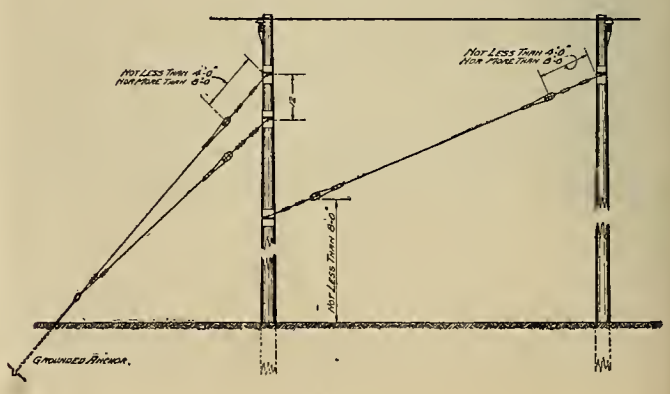


Fig. 7.

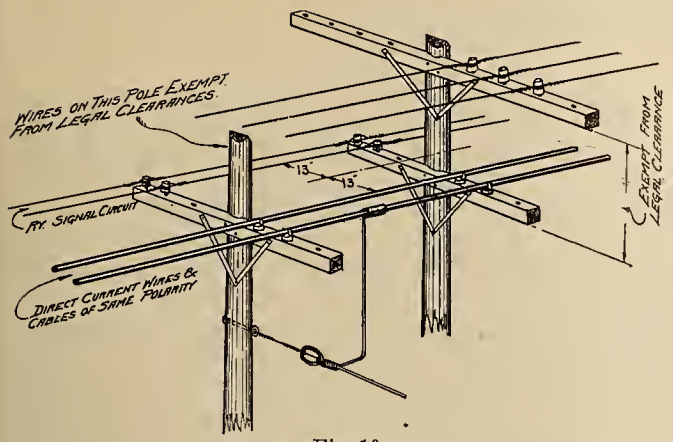


Fig. 10.

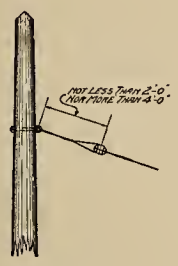


Fig. 11.

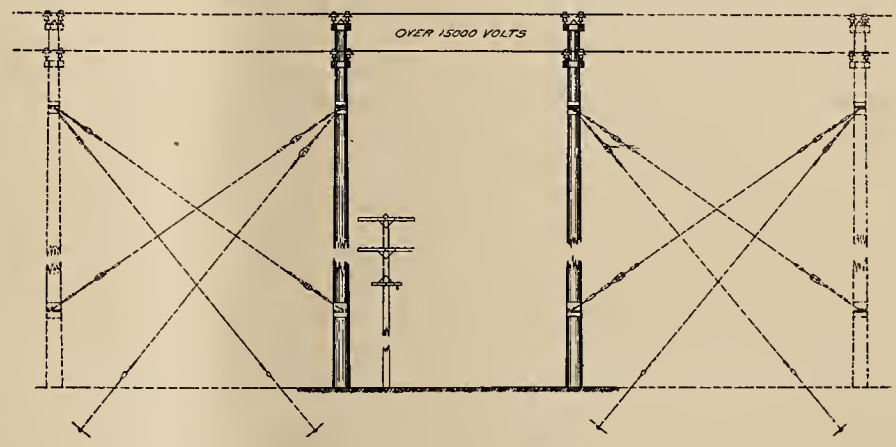


Fig. 9.

ble and from a construction standpoint it is expedient to adopt the more rigid requirements shown in Fig. 3.

(d) Crossarms carrying wires conducting over 600 volts, shall be painted a bright yellow or bear a sign, "High Voltage," on face and back of same; letters to be at least three inches high, white, and on a green background. (See Fig. 6.)

Exception allowed by law:

1. Crossarms carrying over 10,000 volts outside incorporated municipalities.

(e) Guy wires or cables shall be insulated as shown in Fig. 7.

A vertical distance of one foot shall be maintained between points of attachment when two or more guys are attached to same pole.

No insulation is required at lower end of guy attached to grounded anchor.

Exception allowed by law:

1. Guys to poles carrying telegraph, telephone or signal wires or cables outside incorporated municipalities.

(f) Wires used to conduct electricity, placed vertically on poles, shall be wholly encased by casing equal in insulating efficiency to a one and one-half inch wooden casing. (See Fig. 8.)

Exception allowed by law:

1. Vertical telegraph, telephone or signal wires on poles not carrying light or power wires located outside incorporated municipalities.

(g) Arc lamps shall not be attached to poles carrying transformers, or vice versa.

(h) Circuits over 15,000 volts: Legal requirement, high pole, short span, to prevent any wire, if broken, from falling within ten feet of highway or of that used in balance of line. Wires of No. 0000 B. & S. gauge, or larger, are excepted from these provisions, and will be considered as complying with the law.

Note:—For other regulations governing crossings for circuits of over 15,000 volts, see Section 9, General Order No. 26, Railroad Commission, State of California.

coming in contact with wire leads beneath, of less than 15,000 volts.

Alternative:

1. Double strength construction in crossing span with wire equal to, at least, twice cross sectional area

(i) In addition to the standard bolt and clamp, any messenger cable carrying 75 pair No. 19 B. & S. gauge or over, or 100 pair No. 22 B. & S. gauge or over , shall be attached to supporting member by a safety bolt and clamp equal in tensile strength to a standard bolt and clamp.

Section 2.

None of the provisions of Section 1 apply to d.c. wires or cables of the same polarity, nor to signal wires when but two of such signal wires are attached to one pole. A clearance of thirteen inches shall be maintained between such signal wires or d. c. wires or cables, and the center line of any pole other than the poles to which d.c. wires or cables and signal wires are attached. (See Fig. 10.)

Section 3.

Span wires shall be insulated not less than two feet nor more than four feet from point of attachment to pole. (See Fig. 11.)

Exception allowed by law:

1 Feeder wires used as span wires. (See Fig. 10.)

The 112 California gas and electric companies listed by the California Railroad Commission as operating during 1912, had an operating revenue of $39,904,837, paid $6,060,541 in dividends on a capitalization of $341,651,603.

WATER POWER LEGISLATION

NOTES OF RECENT CALIFORNIA CASES ON WATER RIGHTS.

BY A. E. CHANDLER.

Miller & Lux v. Enterprise Canal Land Co., J. G. Jones Co., et al., 47 Calif. Dec. 1, decided December 20, 1913.

This case is very involved as to the facts controlling, but is equally positive as to the legal principles considered.

The defendant, J. G. James Company, is the owner of lands riparian to Fresno Slough, the connecting channel between the Kings River and San Joaquin River. At flood seasons the waters of the Kings flow northward through Fresno Slough into the San Joaquin, at other seasons the Slough receives its water from the San Joaquin. In an earlier case, Turner v. The James Company, 155 Cal. 82, it was held that the James lands being riparian to Fresno Slough were, therefore, riparian to the San Joaquin.

In the case under comment Miller & Lux, the owners of lands riparian to the San Joaquin both above and below Fresno Slough, sought to enjoin the James Company from diverting the waters of the San Joaquin from a point twenty miles above Fresno Slough through the Enterprise Canal to the lands on Fresno Slough.

The James Company claimed the right to do so as a riparian owner, but the Supreme Court held that although a riparian owner may go above his land and divert water for use on his riparian land when he has the consent of the upper owners, he can not do so without such consent.

The following extracts from the opinion clearly show how superior, exclusive and permanent the doctrine of riparian rights is considered in California.

> Again, calling attention to the fact that the diversion of the lower riparian proprietor for use of the water upon his lands is, in its effects, no different from those which would result if the water were taken by a mere appropriator for any other purpose, the conclusion may not be avoided that this court from the first has declared that this may not be done and has in this respect affirmed and adopted the common law doctrine that the riparian proprietor is entitled to the full flow of the stream, reduced only by the proper riparian uses which may be made of the water by proprietors above him. It has said that he may restrain such a taking without showing damage, upon the broad doctrine of riparian rights, that the taking itself is an interference with his freehold which he is entitled to restrain lest it ripen iuto a prescriptive right.
>
> Respondents, in yielding a reluctant acknowledgment of the force of these decisions, in effect, request that they be swept aside and ask why "if a diversion made by a lower owner should defeat in part the natural irrigation of his upper neighbor's land, upon the policy of our laws, it should not be so?" The answer is this: Many questions touching the use of waters arise in this state which were never known to the common law. As those questions arise they will be treated as cases of first impression and the common law doctrine will or will not be followed as shall seem best for our changed conditions. (San Joaquin, etc., Company v. Fresno Flume Company, 158 Cal. 626.) But this precise question in other forms has been frequently presented and as frequently determined. The rights of the riparian proprietor in this respect have often been defined and his right to this uninterrupted flow of the full stream has been declared to be a valuable right and a part of his title to the soil, so at common law it was also declared. These decisions therefore have become and stand as a rule of property, and at this day to overthrow them would not only work a destruction of property rights, but would result in interminable confusion and litigation in the scrambling efforts of every riparian proprietor to go as far up the stream as possible to get water.

California Pastoral & Agricultural Company v. Madera Canal & Irrigation Co., 47 Cal. Dec. 16, decided Jan. 15, 1914.

Plaintiff, an owner of lands riparian to Fresno River, brought suit to have determined the right of defendant to divert from the river above its lands.

The defendant corporation is a public utility engaged in delivering water to irrigators in the vicinity of Madera. It claimed the right to divert water "to the extent of four hundred cubic feet of water flowing per second, when water to that extent was flowing in said river, and at all other times all of the waters flowing therein."

The trial court found that the defendant for over twenty-five years had diverted from the Fresno River up to 250 sec. ft., when that amount was available, and had diverted the entire flow when less than that amount. The court further found, however, that less than the 250 sec. ft. would be sufficient to irrigate the lands irrigated by defendant, but was unable to determine the exact amount necessary. Judgment was rendered by the trial court giving the defendant the right to divert all of the waters of Fresno River up to 250 sec. ft.

The question in issue "is whether, as against a riparian owner, an appropriator of water can acquire title by prescription to the use, for the purpose of irrigation, of any greater quantity than was reasonably necessary for that purpose?"

The supreme court reversed the lower court and decided the question in the negative. The opinion is important as it reviews earlier cases emphasizing the principle that beneficial use, and not the capacity of the ditch, is the measure of a water right by appropriation. The following paragraph is especially noteworthy:

> Whatever right the defendant has acquired by prescription to divert the waters of the Fresno River, is confined to such amount as is reasonably necessary for the lands for which the appropriation has been made. As said in an opinion of the United States circuit court in the recent case of San Joaquin & Kings River, etc. Company v. County of Stanislaus, 191 Fed. 875, it is "based upon and is measured and limited by the beneficial use of certain consumers for which the water is being appropriated," such beneficial use including only such water as is required for the purpose for which it is used.

In order to emphasize the difference between appropriators' rights and those of riparian owners, a principle laid down in Miller & Lux v. Madera Canal Company, 155 Cal. 59, is here repeated:

> The doctrine that a riparian owner is limited to a reasonable use of the water applies only as between different riparian proprietors. As against an appropriator who seeks to divert water to non-riparian lands, the riparian owner is entitled to restrain any diversion which will deprive him of the customary flow of water which is or may be beneficial

to his land. He is not limited by any measure of reasonableness.'

Tyndale Palmer et al. v. Railroad Commission of California & Southern California Mountain Water Co., 47 Cal. Dec 201, decided Jan. 20, 1914.

This was a proceeding to review an order of the railroad commission dismissing a complaint of plaintiffs.

The plaintiffs claimed the right to irrigation water (upon payment of rates) from the water company's system on the sole ground that their lands had been included in the "places of intended use" designated in the notices of appropriation posted by the company. They argued that such designation constituted a dedication of the waters claimed in the notice to public use or the benefit of all the territory described.

The supreme court, in denying the contention of plaintiffs, reviewed the history of the development of the doctrine of prior appropriation in California, and in speaking of Sections 1415-1418 of the Civil Code said:

There is absolutely nothing in this statute to indicate that the legislature supposed that the appropriation made in pursuance thereof was in the nature of a grant by the state of any property of the state in the water of the stream from which the diversion was to be made. As stated in Lux v. Haggin, supra, the statute was a consent by the state to the taking of the water so far as it infringed upon the riparian rights of the state by virtue of any lands which it might own situated upon the stream, and to that extent it operated as a grant. But that was a grant of a right which was private in its nature, a right pertaining to the particular tracts of land owned by the state and held by the state only because of such ownership. It was not a general right to the waters of the stream as a whole. And unless it happened that the state owned land upon the stream at the time of the diversion, a condition which in fact seldom occurred, the state would part with no right whatever by the appropriation. As we have seen there was no existing public right in the waters which the state could transfer to the appropriator. The whole purpose of the statute was to provide evidence whereby parties claiming under hostile diversions could establish their respective priorities and corresponding rights to the water and avoid the former difficulties in establishing the precise date of the inception of their respective enterprises.

In a petition for rehearing, the plaintiffs called to the attention of the court an amendment of April 8, 1911, to section 1410 of the Civil Code, which added the following words to the section: "All water or the use of water within the state of California is the property of the people of the state of California." In declaring that the amendment had no application to the case before it, the court said:

The amendment may possibly be effective as a dedication to general public use of any riparian rights which the state, at the time it was enacted, may still have retained by virtue of its ownership of lands bordering on a stream, rights in the stream which it would in such cases have in common with owners of other abutting land. It could not affect the riparian rights of the other owners, nor the rights of any person or corporation claiming under them, no rights previously acquired from riparian owners by prescription, nor rights acquired from the state prior to that time by appropriation under the code, in reliance upon the implied offer of the state to allow its riparian rights to be acquired in that manner, as indicated in the opinion.

It must be remembered that the language quoted immediately above is by way of dictum only and cannot be considered a full legal interpretation of the amendment. It is clear, however, that for all appropriations initiated prior to April 8, 1911, the water subject to diversion is not public water and does not belong to the state.

The court held that as the territory described in the notice was far in excess of the water available and as the company had not supplied or agreed to supply the plaintiffs with irrigation water, it was not legally bound to do so. The railroad commission had previously held that all the water available was necessary to supply the inhabitants of San Diego.

Desert Water, Oil & Irrigation Co. v. State of California, 47 Cal. Dec. 191, decided January 30, 1914.

The Desert Company, a public service corporation, sought to condemn a section of state land within a national forest. The real issue involved was whether the land on account of being included in a national forest was "appropriated to some public use," as the California statutes allow the condemnation of state land not so appropriated. The supreme court held that the land in question had not been so appropriated and was therefore subject to condemnation by the Desert Company.

In reaching its conclusion the court dwelt upon the difference between the public lands of the state and those of the federal government when included in a national forest, and expressed itself very positively on the policy of withholding large areas of federal public lands in reservation and withdrawals. The following quotation is typical of the statements on this point:

But here we desire to point out that while the state of California was admitted as a sovereign state of the union upon equal terms with all the other states, and while it has been judicially declared that an essential part of that equality is the disposition of the public lands within the state, to the end that the revenues by taxation therefrom and the control over them may be vested in the state, we have in California a withdrawal by the United States from sale and a placing in reserve of one-third of the area of the whole state—an area greater than the combined territory of New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New Jersey and Maryland. Not this alone but we have in these withdrawals a refusal upon the part of the United States to yield to the state of California control over its natural sources of wealth. Its forest, its mines, its oil-bearing lands, its power sites and possibilities, have been withheld by the United States, which proposes to exercise over them, and is exercising over them, the "municipal sovereignty" which the supreme court of the United States in Pollards Lessee v. Hagan declared not to exist.

English municipal trading has aroused much interest in the United States, especially concerning the result of municipal operation of public utilities. Consul Halstead of Birmingham has prepared a comprehensive report thereon. It covers the street cars, gas and electric lighting, water, markets, etc., and shows the profits and losses, rates levied for all the different purposes, etc., in the cities of England and Wales. Gas is sold for domestic lighting supply at 26 cents to 87 cents per 1,000 cu. ft., and electricity for the same purpose at 5½ to 12 cents per kw-hr. Considerable profits accruing from operation of the municipal plants are shown as going toward the reduction of taxes.

LIGHTING METHODS

DESIRABLE QUALITIES OF ILLUMINATION.

BY G. H. STICKNEY.

(Concluded.)

Color.

Advocates of various artificial illuminants have, in the past, made claims of white light or an approximation of daylight color. The claims have, in the main, been made without careful laboratory tests and simply from casual observation.

White it not a simple color, but a combination of all colors in a particular proportion. Our best standard of white light has been average daylight, but since daylight varies in color through the different seasons of the year and different hours of the day, as well as with changes of weather, and is influenced not only by the clouds but also by adjacent buildings, foliage, etc., it is a very difficult matter to state exactly what white light is. Nor are our eyes to be trusted to make a judgment of white light, except under particular conditions when a known standard of white light is available. A very intense light is likely to appear more nearly white than it really is; as, for instance, when we look at a mercury tube, which is of a bluish-green color, and very far from white. Again if we are in the presence of a colored light for a long period of time, it appears to approach white, and in contrast to it, actual daylight may appear to be colored.

There is no artificial illuminant of reasonably high efficiency for the lighting of large areas, whose light approaches nearly enough to daylight to be absolutely reliable for the most accurate color-matching. On the other hand, it has often been assumed that daylight color is essential or desirable in a light for general conditions, when, in reality, a suitable tinted light is fully as desirable or even superior for the purposes for which it is to be used. There are relatively few problems in which accuracy of color is essential. The most severe demands for daylight color occur in such places as dye rooms or textile mills and a few other manufacturing establishments. Certain stores or special departments where colored material for daylight use are sold require a close approximation to white light, though ordinarily not to the same extent as the manufacturing processes. Where materials for evening wear are sold, a light of the same color as the prevailing evening illuminations is preferable to daylight, and on account of this fact it is becoming the practice for stores to establish daylight and evening rooms.

Toward evening and on cloudy days, daylight itself assumes a yellowish tint. This, coupled with the fact that firelight and all the early artificial lights had a yellowish or reddish tinge, has caused our artistic senses to be trained so that light so tinted produces the sensations of pleasure, warmth and comfort, which, for ordinary uses of light, are more important than the actual ability to select and match colors correctly.

Wherever artistic effects are sought, as in restaurants, residences, stores, auditoriums, churches, etc., such a color of light is preferable even to white light, and we frequently find people shutting out daylight and going to the expense of providing artificial illumination, simply to secure this effect. On the other hand, unnatural or extreme variation from white light is exceedingly inartistic and unpleasant, and can be utilized only for rough work and at low intensities where comfort and pleasure are ignored,

Steadiness.

Almost no comment at all is needed on the desirability of having a steady intensity of illumination. Everyone has experienced the unpleasant sensations which accompany a flickering or fluttering light. Not only does the fluctuation interfere with our seeing ability and cause pain, but also by straining the muscles of accommodation, is likely to result in more or less permanent injury to the eyes.

Reliability and Continuity of Service.

In any installation, reliability of illumination is desirable, but in certain installations it is of the utmost importance in order to insure safety and continuation of processes of manufacture. It goes without saying that the watchman's and fire escape lights must be absolutely reliable. In places where there is dangerous machinery, interruption in the lighting may result in deaths or serious injury to employes or breakdown in the machinery. In other cases the delay through lack of operation at a single point, may shut down the whole sequence of manufacture in a mill. From this it will be seen that not only for humanitarian reasons, but for economic reasons, it is essential that continuity of service be insured by using reliable illuminants and by so subdividing that any failure that is likely to occur will not cause serious results.

Economy.

There are many problems in which, on first sight, economy or efficiency seem to be secondary, and it is true that in certain installations there are other considerations which out-weigh the element of cost. It would be poor policy to spoil the decorative effect of a magnificent room in order to secure a relatively small saving in the cost of illumination. In general, however, the cost is an important limitation.

Furthermore, we should not confuse efficiency and economy. An efficient illuminant may have a very high maintenance cost, or may not be so adaptable for the requirements as a less efficient unit. A certain amount of light absorbed in securing proper diffusion may actually result in better seeing value.

In artificial illumination we work very much below ordinary daylight intensities, largely on account of cost. In practically all industrial installations and in a large majority of commercial applications it would be desirable to provide a higher intensity of illumination and a better degree of diffusion than the present practice dictates. The standard of intensity in all classes of illumination is rapidly advancing, owing partly to the reduction in cost of lighting and partly

to the growing realization of the economic value of illumination. Thus, broadly speaking, the economic factor should take into consideration not only the cost but the actual value of the results obtained. There are very few instances in which an economic gain could not be made by a reasonable expenditure in improving the illumination, although it would be a mistake to burden a business with illumination which costs more than the business can reasonably afford to pay.

A low cost can best be secured by selecting relatively efficient illuminants, having low maintenance cost, and arranging them so that the illumination can be utilized to the best advantage.

In making economic comparisons, a proper consideration should be made of the investment feature. It is not likely to be good business for anyone to purchase a system which would either prevent him from taking advantage of improved illuminants or leave on his hands a large amount of expensive obsolete apparatus.

Cost of lighting is very frequently a deciding factor in selecting among several competing illuminants. Each item requires careful analysis in order to insure a true result. It is not an easy matter to equate the lighting values of several illuminants, and what might figure out as the most economical for one problem, may be extremely extravagant for another. Many of the items which go to make up the cost of lighting vary with local conditions and circumstances which cannot always be foreseen.

A simple form of illuminant requiring a relatively small investment and little expert handling is always more advantageous than ordinary comparison of figures is likely to show. Illuminants with delicate mechanisms, requiring frequent repairs and expert attention, have, on that account, unknown elements of cost which are likely to be much higher than would appear from casual observation or test, and these items are likely to increase with the age of the installation.

DETAILS OF A UNIQUE LIGHTING SCHEME.

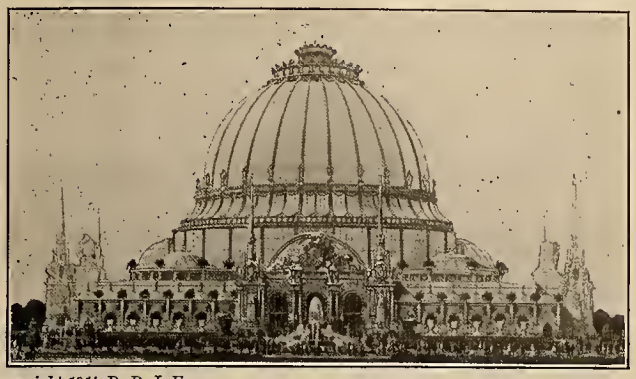
A unique plan for the illumination of the various palaces at the Exposition, has been evolved by W. D'A. Ryan, chief engineer of illumination of the Panama-Pacific International Exposition. Upon his recent return from the East where he has been conducting a series of experiments in one of the largest laboratories of the country the details of the plan for the Palace of Horticulture were explained.

The Palace of Horticulture will be constructed almost entirely of glass and will be surmounted by a dome 150 ft. high and 152 ft. in diameter which will also be fully covered with glass.

If illuminated from the interior by ordinary methods this dome would have presented a "dead" appearance at night instead of being one of the feature spots of the Exposition as it will be with the present scheme in operation.

Sixteen 30-in. searchlight projectors will be placed in a circle about a column in the center of the building.

At the top of the column are arranged a color screen with segments, an opaque vane which will cover two segments at the same time, a lens and a diffusing plate.

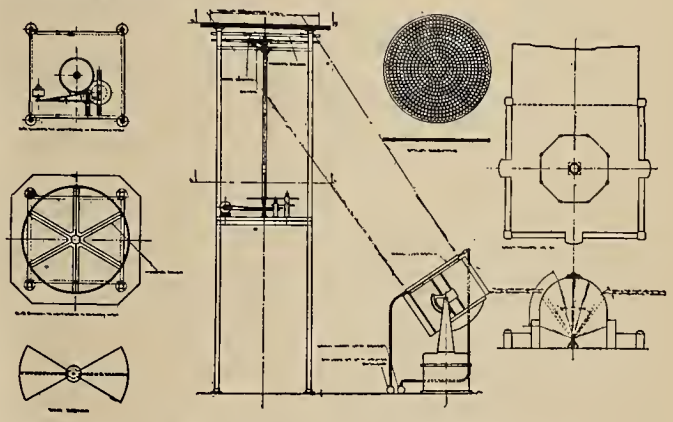


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Palace of Horticulture, P. P. I. E.

The segments of the color screen are of red, green and yellow. The screen will revolve at the rate of 500 rev. per minute and the vane at the rate of 499 rev. per minute. This enables the screen to make one full revolution a minute more than the opaque vane.

The rays of the searchlights are focused on the screen and diffused on to the dome, the revolutions causing the various colors of the spectrum to illuminate the glass.



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Details of Mechanism for Interior Lighting of Palace of Horticulture.

A combination of three lens will be used and so arranged that only one will be in position over the screens at one time. One of these will be composed of a number of tiny lenses which will have the effect of producing "spots" of light upon the dome. Another will be plain. The third will produce the most spectacular effect and will present the appearance of millions of tiny tadpoles squirming about the interior of the dome.

The accompanying illustration shows the details of the mechanism.

The world's biggest ocean liner is to be built at Belfast, according to announcements in English newspapers. It will be of 60,000 tons, whereas the Vaterland is of 58,000 gross tons, the Imperator 52,171, the Brittanic 50,000, the Aquitania 47,000, and the Olympic 46,369 tons. The Brittanic, launched at Belfast on February 26th, for safety, will have 48 of the largest lifeboats yet made, two of them fitted with powerful engines.

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Known bondholders, mortgagees, and other security holders, holding 1 per cent or more of total amount of bonds, mortgages or other securities, none.

A. H. HALLORAN,
Vice-President

Sworn to and subscribed before me this 23rd day of March, 1914.
(Seal.) CHARLES EDELMAN,
Notary Public in and for the City and County of San Francisco, State of California.
(My commission expires April 9, 1914.)

FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

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ERRATA.

In the article "A Weir Problem," by Ben D. Moses, which appeared in our last issue, line eleven from the foot of right hand column p. 270 should read:

200,000 sec. ft. would be $200{,}000 \div q^1 = L$,

and not as shown.

A cut caption was also in error in this article, as that at the foot of p. 271 should have appeared under the line cut on p. 273.

The Conservation of Efficiency

The avowed purpose of conservation is to secure to the greatest number of people and therefore over the longest period, the utmost service from our natural resources. Wherever use may be halted without injury to the present, this constitutes the conservation of preservation, and is commendable. Where non-use is waste, or worse, conservation consists in utilization, and where use is essential, increased efficiency becomes the highest expression of conservation.

To paraphrase Dean Swift, the man who produces from one barrel of oil two hundred and thirty kilowatt hours, where only half that number were produced before, deserves the praise of mankind, and is worth more than all the agitators and politicians put together.

Marine propulsion consumes a large part of the world's fuel supply and constitutes a demand which is increasing annually notwithstanding its present vast proportions.

That the propulsion of ships is essential is not of itself an excuse for waste.

Although an ocean liner the size of the Mauretania uses power sufficient for the needs of a city of half a million population, with the consequent enormous fuel consumption, the power generating and utilizing apparatus aboard most ships is notoriously inefficient.

A policy the opposite to that of true conservation generally obtains.

The promise of the future of the conservation of efficient utilization in the operation of steamships may be found in electrical propulsion.

The log of the good ship "Jupiter" relating to her official trial trip, as written by Mr. H. A. Russell and published in this number, is of more than passing interest in that she is the first vessel of any considerable size in which this principle has been developed and satisfactorily applied.

At first the proposition seems absurd, for it is self-evident that propelling a vessel by electricity involves the conversion of mechanical energy into electricity and its reconversion into mechanical work at the propeller shaft.

The answer is that electrical propulsion not only permits the use aboard ship of the steam turbine, but provides for its efficient operation at the most advantageous speed.

Operation, as well as installation, is simpler.

With this new equipment remarkable efficiencies are now and may be expected. Even since the planning of the "Jupiter" engineering skill has already produced similar apparatus, still more efficient.

As it is, the equipment economizes in space and weight and permits a more extensive cruising radius than heretofore, an advantage to all vessels and especially so to warships.

Previous articles and editorial comment in this journal have detailed the equipment, and this new article emphasizing anticipations realized marks a great forward movement in the realization also of that desirable conservation which efficiency constitutes.

Private Ownership Pioneering

It is private ownership pioneering which awakens sleeping communities and starts them on the road successward. Directly such privately owned public utilities commence expenditures, property values increase, due not only to the greater facilities then assured, but, also, as a promise of the future, to the increased populations which follow always in the wake of such improvements.

Later generations sometimes fail to appreciate the relationship between the success of the public utility and that of the community, and blind to their enormous moral debt of the past, endeavor to condemn the property of the privately owned utility for their own appropriation and use.

Throughout the lean days of development the private utility, as a hazard, struggled onward and upward. Everything was new and use necessitated education of the public, especially where the service sold was electric light and power.

At first the public was afraid, but with tremendous effort the central station companies caused them to look favorably on their service. The public has, perhaps, been overtrained, and now, like Oliver Twist, eternally asks for more.

But of the utility the public says: "This is the heir; come let us kill it that the properties may be ours."

Yet before the utility came that public was content with the existing order with its candle light, manual power, pedestrian proclivities and limitations. Unambitious for change, with highways which might have been used to facilitate electrical transportation and distribution, with property which might be assessed for the purpose of public works, and even with the industrial world ready to provide equipment for their needs, the public, failing to grasp its opportunity, slept.

It is private ownership pioneering, urged by a desire to serve, which arouses these communities from their Rip van Winkle sleep, and by utilizing some of their neglected opportunities, gives to them all the advantages of electricity in its application to human needs.

Seeing the progress made—the beginnings of a success for the private corporation—the public considers that the heights of endeavor have been scaled and the principle is expressed, "Let us build three tabernacles," But now, as ever, the voice cannot be silenced, for private enterprise urges, "Get thee hence, for this is not thy rest." Improvement and progress cannot be persuaded to stand still.

Private enterprise may mock the efforts of those who under a cloak of public ownership would take from the private corporation the present just reward of its pioneering endeavor.

The decalogue of today abhors injustice, and if it is shown that municipalities (the public) may condemn such property for their own use, then the power to regulate public utilities should simultaneously be withdrawn from them.

Otherwise who is it regulate the regulator?

In such instances the regulator is governed by and should express the principle of justice, which is its purpose.

Remove justice and automatically you abolish the regulator.

Private ownership pioneering by the impulse of its power and purpose is entitled to and should receive justice in full measure.

And if municipal ownership must be, why not try it out in virgin territory? Elsewhere there is undeveloped water power and a myriad sleeping communities.

But they are not self-starting.

Western Electrical Pre-eminence

There is an old adage that "figures don't lie." This is and is not true, depending entirely upon who does the figuring. Numerical facts —statistics—do not lie. Here the word "statistics" is used in connection with figures gathered by direct enumeration and honestly collated.

In the collection of nation-wide statistics the human element, with the possibility of error in isolated instances must enter, but with an area under consideration as large as the United States, accidental divergencies tend to neutralize each other, and their baneful influence upon accuracy is in this way eliminated.

Statistics bear the same relation to the administration of government that a good system of bookkeeping does to any business. Accuracy is essential.

In the consideration of statistics those gathered by government are most reliable, coming as they do from an unprejudiced source, representing the most comprehensive and thorough method of collection, and being published without fear or favor.

When government does the figuring, it is safe to assume that figures do not lie.

It is therefore at once refreshing and stimulating for the West to turn to and consider the electric lighting statistics recently issued by the Bureau of the Census and referred to, in tabloid, in the map published in our issue of last week.

That the West leads electrically is seen at a glance, which at the same time approvingly endorses the West as of premier importance to those interested in the sale of things electrical.

It is not suprising that in Pacific Coast cities are to be found central stations having the highest load factors of all comparable companies in the United States. Corroboration, if such were necessary, that the West does know how to "Do It Electrically," and that the West is prepared to follow out that program wherever any manufacturer will prove that the electrical way, or his particular path along that way, is best.

To the Journal this is a cause for congratulation and commendation.

For the past twenty-five years the Journal has been interested, and, we may add with all modesty, partly instrumental, because of our advantageous position and its opportunity seized, in contributing to this incomparable growth and leading electrical position of the territory we principally serve—the West.

The Journal takes this opportunity to congratulate its readers and advertisers on the wonderful Western progress shown by these statistics.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

Fred F. Skeel, sales manager Crouse-Hinds Company, Chicago, Ill., is at Los Angeles.

George Cook, of the American Cross Arm Company, spent Thursday of last week at Seattle.

W. H. Leffingwell, hydraulic engineer Mono Power Company, Bishop, Cal., is at San Francisco.

George J. Henry, consulting hydraulic engineer, San Francisco, has returned from Salt Lake City.

E. B. Criddle, district manager, Southern Sierras Power Company, Bishop, Cal., is at San Francisco.

H. T. Hays, purchasing agent Mt. Whitney Power Company, was recently at San Francisco from Visalia.

Howard J. White, manager, Keeler, White & Company, manufacturers' agents, San Francisco, is at Seattle.

W. N. Chatfield, general manager, Pacific Power Company, Bodie, Cal., was a recent San Francisco, visitor.

W. L. Goodwin, baseball fan extraordinary at San Francisco, is trying to solve the question "Why is a Tiger?"

Frank E. McCoy has joined the sales force of the Benjamin Electric Manufacturing Company at San Francisco.

Hal Lauritzen, manager, Western Division Holophane Works of General Electric Company, is at Los Angeles, Cal.

K. G. Dunn, vice-president Hunt, Mirk & Company, engineers and contractors, was at Los Angeles recently on business.

H. C. Goldrick, Pacific Coast manager, Kellogg Switchboard & Supply Company, San Francisco has returned from Hawaii.

J. O. Presbey of the Holophane Works of General Electric Company, is spending a month at Seattle on company business.

O. S. Hansen, of the National Pole Company, Everett, Wash., was at Seattle on business during the early part of last week.

Sylvester A. Baker, Pacific Coast representative Macbeth Evans Glass Company, has returned to San Francisco from Salt Lake City.

W. W. Torrence, local manager, General Electric Company, Salt Lake City, has returned from his regular trip of inspection to the factory.

J. M. Smith, assistant to sales manager, Holophane Works of General Electric Company, Cleveland Ohio, is expected to arrive in San Francisco shortly.

Grover Anderson, salesman for the Electric Appliance Company in Arizona territory, is making his regular call at the home office, San Francisco.

C. C. Barrick, president of the Union Metal Molding Company, Canton, Ohio, is visiting Pacific Coast cities and spent last week at San Francisco.

W. W. Low, president, Electric Appliance Company, Chicago, Ill., who has been spending several weeks on the Pacific Coast, is now en route East.

S. Warren Mays, representing American Cyanamid Company, Nashville, Tenn., was a recent visitor at San Francisco and has now left for Los Angeles.

E. W. Price, formerly electrical contractor and dealer of Vancouver, B. C., is at San Francisco with the object of engaging in business somewhere in California.

C. B. Babcock, Pacific Coast representative, General Gas Light Company, has returned to San Francisco from a business trip made throughout Southern California.

Miles F. Steel, sales engineer, Benjamin Electric Manufacturing Company, is again in San Francisco, having made a very successful business trip throughout the Pacific Northwest.

A. J. Myers, district manager of the Wagner Electric & Manufacturing Company, has returned to his San Francisco office from an extended trip through Southern California and Arizona.

C. L. Fraser, Wm. B. Bennett, M. E. Heberling and **Wm. Ingram**, of the meter department, Mt. Whitney Power Company, Visalia, Cal., enjoyed an extended visit to San Francisco last week.

W. R. Studenmund, representing Gillinder & Sons, Inc., manufacturers of illuminating glassware, is back again at his office in San Francisco, having completed a business trip through Southern California.

Geo. Hughes, president of the Hughes Electric Heating Company, was a Seattle visitor last week and also visited Bellingham, Wash., in company. with **H. D. Brainard**, local manager Western Electric Company, Seattle.

Allen E. Ransom having completed his duties as receiver and trustee of the Caldwell Machinery Company, has opened an office as manufacturers' agent for pumping and hoisting equipment in the Colman Building, Seattle.

C. R. Bishop, secretary and manager, American District Steam Company, New York, was at Portland during the past week. **E. L. Barnes**, northwest manager of the company with offices at Seattle, also accompanied Mr. Bishop.

Z. S. Gwaltney has accepted a position as manager of the Salt Lake Electric Supply Company. Mr. Gwaltney comes to Salt Lake from Kansas City, where he has been engaged in the electric supply business for several years.

C. H. Carter, district manager Pacific States Electric Company, has returned to Los Angeles after having made an extended Eastern trip, during which he visited the headquarters of various manufacturers represented on the Coast.

C. M. Clark, of Philadelphia, chairman board of directors, Portland Railway, Light & Power Company, was a visitor at San Francisco last week, accompanied by Mrs. Clark and Edward W. Clark. **Franklin T. Griffith**, president of the company, was also one of the party, who are now en route East.

Ralph B. Clapp, one time Jovian Statesman at Los Angeles, who recently deserted the electrical field, has made a quick return, which will be pleasing to his many friends among the electrical fraternity. Mr. Clapp is now associated with F. Foster & Company, agents for industrial and electrical equipment, 443 East Third street, Los Angeles, Cal.

J. A. Spears, as manufacturers' representative, has opened offices in rooms 224 and 228 Monadnock Bldg., San Francisco. Mr. Spears was connected with the electrical department of the H. W. Johns-Manville Company from which he resigned to engage in this new business, and was formerly sales engineer with the Holophane Works of General Electric Company.

OBITUARY.

L. N. Peart, general superintendent of the San Joaquin Light & Power Company, and **J. E. Burgess**, assistant superintendent of the company, met death by drowning on March 28, 1914. Both were of an automobile party, which was precipitated into the San Joaquin River with the machine when a suspension bridge broke over which they were crossing. Three others were also drowned at the same time. The San Joaquin River at the point where the auto plunged from the broken bridge is extremely swift. An eye-witness of the accident stated that both men rose once to the surface and were then rapidly carried away by the current. It was at first thought that the superintendent and his assistant might have saved themselves, but after searching parties had traversed the banks of the river for several miles hope was abandoned. They were both graduates of the University of California. Mr. Peart had been connected with the power company for ten years.

MEETING NOTICES.

San Francisco Section A. I. E. E.

On Friday evening, March 27th, a large attendance of members and friends at the Engineers' Club, listened to the presentation of a paper on "Economics of Electrical Transmission and Distribution," by C. L. Cory. It evoked an interesting discussion. The paper and discussion will be printed in full in an early issue of this journal.

Seattle Jovian League.

The Jovians met at luncheon at the Lincoln Hotel Friday, March 27th. Thirty members present enjoyed a one-half hour after dinner talk by Mr. Carson, chairman of the "Safety First" committee of the Puget Sound Traction, Light & Power Company. Mr. Carson's talk gave the members present a clear insight as to what has been done and is being accomplished towards decreasing the number of accidents in transportation due to carelessness of employes and the public.

Utah Electric Club.

At the regular meeting held at the Commercial Club March 26th, Willard Done, State Commissioner of Insurance, spoke to the subject, "What the State Is Doing to Protect the Insured." He outlined clearly the relations which exist between the insurance companies, their agents, and the insuring public, and the manner in which the state supervises the placing of insurance so as to protect the interests of all three. He paid a high tribute to the insurance agents doing business within the State, saying that with but few exceptions they are working to the best interests of their policy holders.

Twin Falls Jovian League.

Professor Hylon T. Plumb of the engineering department of the General Electric Company, with headquarters at Salt Lake City, delivered a lecture on the subject of "Electricity on the Farm" at the Commercial Club rooms, Twin Falls, Idaho, on Saturday evening, March 21st. The lecture was illustrated with lantern slides and presented in a highly interesting and instructive manner. Arrangements have been made to have other lecturers discuss electrical subjects before the Jovian League of Twin Falls during the next few months. H. T. Fulton is president of the league and H. S. Bates, secretary.

Alameda County Electrical Development League.

The regular monthly luncheon at Oakland was held on March 28th, there being a large and enthusiastic attendance. The chief subject for discussion was the advisability of endorsing the work of league members, but following the statement that the electrical contractors' association had this plan in mind it was decided that the league should take no present action. The establishment of a Grievance Committee was also considered and will be decided at the next meeting. The secretary was instructed to request the Society for Electrical Development to establish a Pacific Coast office.

Joint National Committee on Electrolysis.

At the first meeting of the present members of the Joint National Committee on Electrolysis, held in New York on May 27, 1913, it was decided, owing to the fact that certain national associations had not at that time appointed representatives to serve on the committee, to have a temporary organization only, and await the meeting of the full committee before perfecting a permanent organization.

At this meeting Bion J. Arnold was appointed temporary chairman, and he was requested to confer with the National organizations not at that time represented on the committee.

The Jovian Electrical League of Southern California.

The weekly luncheon of the League on March 25th, which was well attended, was held at Christopher's, Los Angeles, and was presided over by W. F. Rath. A stirring and eloquent description of a Mexican bull fight was given by Judge James J. Banks, formerly of the supreme court of Alabama, who had only recently witnessed such a contest between the cool intelligence of a human being and the brutal strength of an enraged beast. The judge referred to this cruel sport as the great equalizer in Mexico.

The League placed itself on record as favoring the setting aside of March 21st of each year as Southern California Orange Day. Announcement was made of a pool tournament to be held on April 8th for the purpose of raising money for the Jovian degree team trunk.

Utah Light & Railway Company Section, N. E. L. A.

The regular monthly meeting was held at the Consolidated Music Hall Wednesday, March 25th. This was the first session held in this hall, arrangements having been made by the company to hire it for the regular meetings of the Section. Morrill N. Farr and G. B. Walker were appointed a committee to arrange for the Section's big outing and field day to be held early in June at Pine Crest, the new hotel and summer resort opened at the head of Emigration Canyon.

The paper of the evening was presented by Wm. M. Scott, superintendent of electric lines and service, entitled "The Relation Between the Company and Its Employes." Mr. Scott's paper was one of the most valuable which has been presented to the Company Section. His wide experience during the past twenty years of his employment with the company has admirably fitted him to handle this subject.

Electrical Development and Jovian League.

Last Tuesday's meeting was electrical vehicle day at the League, as in addition to the League members some thirty or more men interested in the electrical vehicle business sat down to luncheon. The meeting was called to order by H. R. Noack who acted as chairman in the absence of President Neiman and explained that one of the objects of the gathering was to afford the vehicle men an opportunity of forming a Pacific Coast section of the National Vehicle Association. After addresses by Messrs. I. L. de Jongh and C. W. Hutton, the business end of the meeting was turned over to Mr. A. H. Halloran, secretary of the former Pacific Coast Electric Vehicle Association, who took up the question of permanent organization.

Upon motion of those present Mr. Stanley Walton was elected chairman, C. W. Hutton, vice, chairman, and J. W. Redpath, secretary of the new section. Messrs. E. M. Cutting, W. C. Logan, George R. Murphy, I. G. Perin, A. G. Jones, O. W. Lilliard and W. D. Vance, were elected members of the executive committee. The new branch of the association should serve to arouse considerable interest in the electric vehicle and contribute to the extension of that business.

The new meeting place of the League appears to curry much favor as the attendance at meetings is rapidly increasing.

PUBLICATIONS RECEIVED.

How to Build up Furnace Efficiency is the title of a 5x7 in. booklet with stiff paper covers, written and published by Jos. W. Hays, combustion engineer, Rogers Park, Chicago, U. S. A. It contains 126 pp. and is well illustrated. It has chapters on why and how fuel is wasted, how to detect and stop this waste and how to keep it stopped.

PLAY BA—A—ALL.

Peddlers vs. Pawnbrokers.

All-star nine of pickled peddlers, recruited from the ranks of itinerant salesmen, will play the Pacific Gas & Electric's purchasing department players at Ocean Shore Grounds, Twelfth and Mission streets, San Francisco, Saturday, April 4th. Game called at 2:30 p. m. Stakes—a big French feed. Come one—come all. Pirates welcome this time only. Parking privileges provided for your autos.

CALIFORNIA ASSOCIATION OF ELECTRICAL INSPECTORS

Section of N. A. E. I.

C. W. Mitchell, President. Arthur Kempston.
Wm. G. Pennycook, Vice-Pres. B. C. Hill, Executive Comm.
John W. Carrell Secretary-Treasurer, 55 Fulton, San Francisco.

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correllate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

By the Secretary.

The regular meeting of the Section, held Saturday, March 28th, at the Merchants' Exchange Building, showed an increased membership and an unabated enthusiasm. Almost the entire time was consumed in reviewing the wonderful array of data on electrical appliances compiled by the Fire Underwriters and presented by Mr. Mitchell. The sessions will now be devoted to actual construction in buildings, starting from the place of connection to the source of supply and "following the feed" through the building. The next topic will be Main Service Wiring.

One thing that the meetings have emphasized is that inspectors should be liberal minded men. The creed of the egotist:. "An agreeable person is one who agrees with me. That which I believe is right absolutely, and that which you believe that I believe is right also, but that which you believe that I do not believe is wrong, has little place among us." Our members are fully persuaded that all the brains in the electrical fraternity are not confined to the several inspection bureaus and realize that suggestions along the line of the work and especially questions on actual construction, are a valuable asset. Above all send us your questions.

Questions and Answers.

Ques. 1. Does the Code require gas pipes above insulating joints to be protected with insulating tubing where outlet boxes are used?

Ans. 1. Yes. Rule 30 (a).

Ans. 2. Yes. Refer to Rule 30 (a). My interpretation of this rule does not necessarily call for insulating the pipe above the insulating joint, but would accept flexible tubing extending below insulating joint from where wires enter the outlet box, if fastened with approved loom clamps.

Ans. 3. No. If I did, I would require a lined box also.

Ans. 4. Yes. Rule 30 (a) of the Code.

Ans. 5. No. The Code recommends, but does not require outlet boxes to be used and does not treat this point where outlet boxes are used. I presume the question applies to knob and tube work. Under the heading of Armored Cable and Conduit no mention is made of this subject.

Ques. 2. A straight electric fixture is supported from a conduit system, is wired with No. 16 rubber covered and has three receptacles, each having porcelain shells. Does the Code require an insulating joint?

Ans. 1. Yes. Rule 30 (a).

Ans. 2. Yes. Refer to Rule 30 (a) Code. If No. 14 wire were used I would not require an insulating joint.

Ans. 3. No. While the insulation on No. 16 wire is not of the same thickness as that of No. 14 it is made for use where the potential does not exceed 600 volts. See Rule 50.

Ans. 4. Yes.

Ans. 5. No, if No. 16 wire with three-sixty-fourths insulation is used. Yes, if ordinary No. 16 rubber covered is used.

Ques. 3. Armored cable is used for a vertical run from a junction box in the ceiling of the first story to a point on the side wall seven feet above the floor of the second story. Does the Code require the armor of the cable to be grounded?

Ans. 1. Yes. Code 27 (c).

Ans. 2. Yes. Refer to Code, Rule 27 (c). In this city the local rules make exceptions and do not require grounding of armored cable or conduit if length does not exceed ten feet where the potential difference between the wires does not exceed 125 volts.

Ans. 3. Yes. See Code Rule 27 (c).

Ans. 5. Yes, 27 (c).

COLUMBIA AND SNAKE RIVER WATERWAYS ASSOCIATION.

The fifth annual convention of this association will convene at Portland, Oregon, at 10 a. m., on April 13, 1914, and will continue until the evening of the 14th. All sessions will be held at Portland Commercial Club, Fifth and Oak streets. The formal sessions will be devoted to the discussion of waterways and allied topics. The annual meeting of the board of directors will first take place and after the annual address of Geo. F. Richardson of Kennewick, Wash., president of the association, the afternoon will be devoted to a presentation of papers and discussion on navigation subjects. A reception will be tendered to delegates and visitors by the united commercial and business men's organizations of Portland, A. H. Averill, president Portland Chamber of Commerce, presiding. Governors of the states of Oregon. Washington, Idaho, Montana and of the Province of British Columbia are expected to participate.

Other navigation matters of importance will be discussed at the morning session of the 14th.

At the afternoon session the principal paper will be "Hydroelectric Development of the Columbia and Its Tributaries," by Hon. H. B. Miller, chairman Oregon Hydroelectric Commission, of Portland. Discussion will be led by Robert A. Foster, manager Lewiston-Clarkston Improvement Company, of Clarkston, Wash., and Hon. James Allen, Washington State Hydroelectric Commissioner of Olympia. Other papers to be presented will deal with various phases of water transportation and navigation and the session will conclude with a series of moving pictures of the various projects and waterways discussed.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The commission has rendered a decision in which it suspends, until the 15th of April, any final order on the application of the Hermosa Beach Water Company to withdraw from territory embraced within the limits of the city of Manhattan Beach. The company serves Hermosa Beach, El Porto and Manhattan Beach.

The commission rendered a decision granting authority to the Pacific Gas & Electric Company to issue $7,000,000 of one year 5 per cent notes, the notes to be secured by $5,000,000 of the company's general lien bonds and $5,000,000 of the company's general and refunding bonds. The notes will mature on March 25, 1915.

The commission has rendered a decision authorizing the Oakdale Gas Company, operating in Stanislaus county, to issue first mortgage 6 per cent 25 year bonds of the face value of $13,000 and 8000 shares of its capital stock of the par value of $1 per share. Bonds and stock are to be sold at not less than 80, so that the net proceeds of both to the company shall be at least $20,000.

The commission has rendered a decision in which it modified its former order made on the application of the Los Angeles Gas & Electric Corporation to issue $900,000 in bonds. The original order required that the bonds net not less than 94⅛ on the first $250,000 and not less than 94⅝ on the remaining bonds; $400,000 of the amount authorized has been disposed of. The modification permits the company to sell the balance at not less than 92 plus accrued interest.

THE ELECTRICAL CONTRACTORS' DEPARTMENT

ESTIMATES RELIABLE AND COMPLETE.

The San Francisco Local chapter of the California State Association of Electrical Contractors has developed and published for the benefit of its members, blank forms which will be conducive to more reliable and complete, and probably more uniform estimates than has heretofore been the case.

These consist of a Data Sheet (Fig. 1.) onto which is transferred from the plans and specifications all the material which will be required for carrying out the full intent of the plans and specification. These quantities are then summarized on the same sheet which is here reproduced, the blank space for entering the quantities having been omitted. This data sheet measures 10½x18½ in. It is ruled on one side only, the opposite side being left for the entry of any additional data required.

The quantities in this way determined are then entered upon the Electrical Estimate Sheet (Fig. 2) with headings as shown on the second illustration herewith. This sheet is so

ELECTRICAL ESTIMATE SHEET

DATE — PREPARED BY — ESTIMATE No.

OWNER — SAN FRANCISCO DISTRICT LOCAL NO 1 — BID TO

LOCATION — THE CALIFORNIA STATE ASSOCIATION OF ELECTRICAL CONTRACTORS — ARCHITECT

LABOR — VARIABLES — LABOR — CONSTANTS

Fig. 2.

arranged that the amount of the labor for the installation of each item may be placed opposite to it, also the unit cost and total cost of all quantities called for. These items are listed under two divisions, the Variables, like the goats they are, on the left, and the Constants on the right.

The variables listed are as follows, though ample provision is made for any additional items that may occur:

Service Switch, Service Switch Remote, Time Switch, Floor Receptacles, Base Receptacles, P. B. Switches, 3 W Switches, Lock Switches, Door Switches, Pendant Switches, Circuit Porc., Circuits on Panelboards, Trim for Panelboard, Main Switch Board, Case or Screen, Pull Box, Load Center Panel, Meter Panel, Meter Loops, Drop Cords, Lamp Receptacles, Lamps and Guards, Fixtures.

Power. Feet of ½ in., ¾ in., 1 in., conduit or of other sizes. Feet of service conduit. Feet of wire (by numbers), service wire and lead wire. Switches.

Tel. and Messsengers. Feet, No. 18 Triple Wire, 19 Twist. Pair, 14 Ground Wire, 16 Wire, 18 Bridle Wire, 19 Bridle Wire, Pr. Lead Cable, ½-inch Conduit, Leader Pipe, Outlet Boxes, Terminal Strips, Terminal Boxes, Telephones, Annunciator, Bells and Buzzers, Push Buttons, Batteries and Trans., Door Opener, Bell Wire, Letter Boxes, Speaking Tubes and Whistles, Burglar Alarms.

These are then summarized under Material, Labor, Total Variables.

Constants are itemized as follows:

Outlet Boxes, Covers, Stems, Boxes (Receptacle), Boxes (Switch), Covers (Switch), Panel Boxes, Locknuts, Bushings, Pipe Straps and Hanger, Toggle Bolts.

Branches. Feet of ½ in. Conduit, ¾ in. Conduit, 1 in. Conduit, Metal Moulding, Metal Moulding Fittings. Feet of 14, 12, 10 Duplex Wire, Knobs, Bushings, Flexible Conduit.

Mains. Feet of Conduit (by sizes), Conduit for Service, Service Wire, Lead wire, Condulets, Elbows, Tape, Solder, etc., Ground Clamps, Miscellaneous.

Inspection, Service Connection, Bond, Fire Insurance, Compensation Insurance, Car Fare, Cartage, Drafting.

These are all summarized and the Cost of the Constants and of the Variables, added together. This total cost secured the Overhead is added together with the profit desired and the complete bid arrived at in this way.

The use of these forms should simplify the preparation of assured and reliable estimates and their general adoption would also tend to overcome the absurd differences in the amounts of different contractors when the bids are opened.

Further particulars may be secured from W. S. Hanbridge, secretary, state of California, Electrical Contractors' Association, San Francisco, Cal.

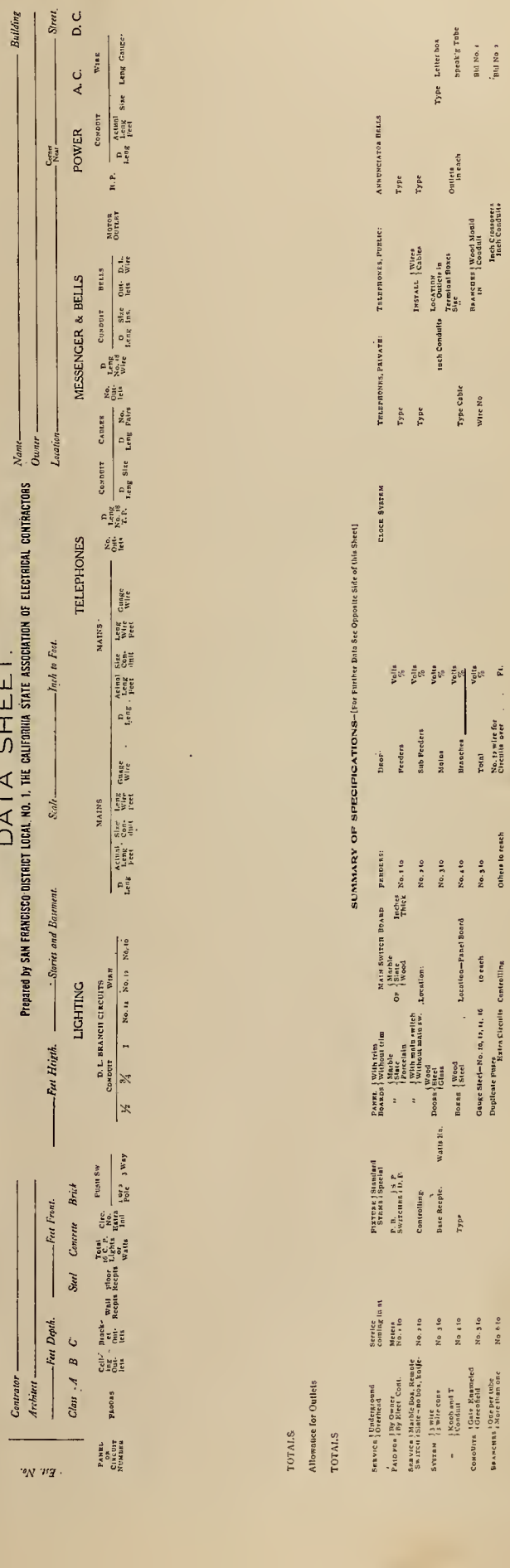


Fig. 1.

INDUSTRIAL

SHORT-CIRCUITED TEST OF A LARGE GENERATOR.

In the presence of a number of representatives of central stations, the engineers of the Westinghouse Electric & Manufacturing Company deliberately short-circuited a 16,700 k.v.a., 8800 volt generator, running at full speed and without resistance or any other protection in the circuit. Oscillogram records showed that a current of 21,000 amp., or 12½ times normal, flowed through the generator.

With generators designed some years ago such a test would have wrecked the machine but in the present instance no damage resulted whatever. The only visible effect was a static flash between the field and the armature.

The test was performed to prove the fact that generators are being built that require no outside protection from outside short circuits, the generator itself being so designed as to be self-protecting. Unless the generator is properly constructed a complete short circuit tears out the armature coils, which, coming into contact with the revolving field, causes extensive wreckage. Furthermore, the static flash, which always occurs under such circumstances, will destroy inferior insulation. With generators of the type tested both results are guarded against by firmly securing the armature coils and bracing their ends and by the use of mica insulation. In consequence even so severe an ordeal as this test was withstood without harm, although it has been repeated many times with the same machine.

In connection with this test several others were carried out in order to prove the reliability of circuit-breakers and reactance coils for protecting the feeder circuits. The generator was repeatedly short-circuited through these devices which stood up admirably under the enormous stresses to which they were subjected.

The practice recommended by the Westinghouse engineers is to protect the feeders and not the generators. If the generators are protected and a short circuit occurs on any of the feeders, even a poorly designed generator will not suffer, but the voltage will fail on all the feeders, all synchronous motors will be thrown out of step, and an overwhelming overload will be thrown on the circuit-breaker of the short-circuited feeder, since it will carry the total current of all the generators in the station. If, however, protective reactances are placed in each feeder circuit, and a short circuit in a feed occurs, only that feeder will be affected and even then its reactance coil will prevent the current in it from rising to too high a value. The voltage will be maintained at the bus bars and no disturbances will be felt in the remaining feeders. This happens, of course, provided that the generators are self-protective; if not, such an event may seriously injure them.

THE DIESEL ENGINE.

"The Diesel Engine" is the subject of a book being distributed to interested parties by Busch-Sulzer Bros.-Diesel Engine Company of St. Louis. In its 112 beautifully illustrated and handsomely printed pages is a wealth of valuable information on the history and development of the Diesel engine, its efficiency and economy and theory and operation. Pictures and descriptions are given of typical installations throughout the country and of its adaptability to many industrial uses. The volume is concluded with a careful compilation of engineering data useful in making estimates for power installations. W. S. Heger, Rialto Building, San Francisco, is manager of the Pacific Coast Sales Department of the Busch-Sulzer Bros.-Diesel Engine Company.

FILTERING LUBRICATING OIL.

Some interesting statements as the result of experiments made by the Cornell University have been published by the Richardson Phenix Company, Lubrication Engineers & Manufacturers, Milwaukee, Wis. They may be summed up briefly as follows: If properly filtered, oil may apparently be used indefinitely without losing its lubricating properties. The fact that a power plant like that in the Hotel McAlpin, New York, pays for less than two tenths of one per cent of the amount of oil used and that oil can be purified in a commercial filter and returned to an oiling system in a state of purity equal to the new oil, is certainly of vast importance in the economical operation of power plants, and the old-fashioned idea of purchasing a barrel of oil and letting it drip to waste is certainly as out of date and uneconomical as Watts' original scheme of condensing the steam directly in the engine cylinder. The saving in the cost of the oil in the above plant by the use of the oiling system amounts to over two thousands dollars per month, but who can compute the amount of coal saved by the reduction of friction or how much wear and tear on the machinery is reduced. It is safe to say that the money value of these savings is at least as great as the reduction in the oil bill.

MAZDA LAMP PRICES REDUCED.

Below is given the new prices in effect April 1st, and constituting a further factor in the general and continued downward revision of the cost of electric light:

Price List.

Volts.	Watts.	New Price. Clear.	New Price. Frosted.	Old Price. Clear.	Old Price. Frosted.
	10	$0.30	$0.33	$0.35	$0.40
	15	.30	.33	.35	.40
	20	.30	.33	.35	.40
100	25	.30	.33	.35	.40
to	40	.30	.33	.35	.40
130	60	.40	.44	.45	.50
	100	.70	.77	.80	.90
	150	1.10	1.20	1.20	1.30
	250	1.80	1.95	2.00	2.15

It will prove of intense general interest that these prices are to be charged uniformly by all central stations and dealers in electrical supplies.

TRADE NOTES.

Westinghouse, Church, Kerr & Company, of Montreal and New York, have been retained by the Canadian Pacific Railway as engineers to investigate the matter of the proposed electrification of the new double track 5½ mile Selkirk tunnel in British Columbia. The investigations will cover in general the type of system to be installed, the relative economies of steam and water power and the effect of the electrification upon operating conditions.

The offices and display rooms of the San Francisco branch of the Welsbach Company, have recently been removed to more commodious quarters, 863 Mission street, between Fourth and Fifth.

The Foulkes-Gaylord Company, Los Angeles, Cal., has been awarded the electric wiring contract for the New Broadway department store of that city, amounting to $40,000.

The Pacific States Electric Company was awarded the contract to furnish 40 ornamental street lighting standards for Eagle Rock, Cal.

NEWS NOTES

INCORPORATIONS.

SAN DIEGO, CAL.—El Centro, Imperial & Calexico Electric Railway Company, $200,000, by L. R. Kirby and others.

SAN FRANCISCO, CAL.—Electrical Specialty Company, incorporated at $50,000, shares $1 each, subscribed $4, by D. David, A. C., W. A. and E. Gribble.

RED LODGE, MONT.—Carbon & Stillwater Electric Railway Company, has been incorporated for $750,000 for the purpose of building an interurban railroad between Red Lodge and Columbus, a distance of 40 miles.

ILLUMINATION.

AZUSA, CAL.—Bonds for an electric light system in the sum of $20,000 were voted here recently.

VENTURA, CAL.—The Pacific Gas & Electric Company has made application to the board of supervisors for a franchise to install and operate a gas and electric system in Ventura county.

HEMET, CAL.—The city trustees are considering plans for a better lighting system. It is estimated that a plant large enough to supply the city with sufficient lights will cost less than $3000.

ALBANY, ORE.—The Commercial Club has launched a campaign for a municipal electric light and power plant. A. M. Hammer is chairman, and G. T. Hockensmith and C. H. Stewart complete the committee.

PORTLAND, ORE.—The Portland Gas & Coke Company has renewed its application for a permit to construct a mammoth gas retainer at East Twelfth and Clinton streets. It is estimated that the structure will cost about $250,000.

CULDESAC, IDAHO.—W. L. Marrs of Coeur d'Alene has applied for a franchise to operate a light plant in Culdesac. Mr. Marrs was here some time ago looking over the plant of E. P. Atchison with a view to purchasing it and placing it in operation.

WALLOWA, ORE.—The committee appointed to look up data upon municipal ownership of an electric light plant made a report. W. G. Trill, acting spokesman, read communications from many cities stating that their municipal plants were paying propositions.

VENICE, CAL.—The city trustees will erect ornamental arches at the city limits on all boulevards leading into the city. At night these arches will be illuminated and will be discernable for many miles. The word "Venice" will be painted in large letters on the arches.

SEATTLE, WASH.—The monster 8 foot globe on the top of the 42 story L. C. Smith Building in Seattle, was lighted for the first time Saturday, March 21st, with four 750 and two 1000 watt nitrogen lamps. The lights were visible from all parts of the city and far out on Puget Sound.

SALT LAKE CITY, UTAH.—Upon the invitation of the Home Economic Section of the Ladies' Literary Club, the Utah Light & Railway Company gave a practical demonstration of the operation of electric cooking and heating appliances before this section at the club's new home on East South Temple.

PHOENIX, ARIZ.—The Southside Gas & Electric Company has purchased the present electric light equipment from the Chandler Improvement Company, and the new company will be ready to serve practically all of Chandler within 60 days. F. L. Chandler, president of the company, states that gas will be piped from the mesa plant to Chandler soon.

LOS ANGELES, CAL.—Plans for the 1915 electrical display in the streets of the city call for an appropriation of $50,000, minimum, and $100,000, maximum. It is the idea of the committee to get away from the usual stringing of lights from one side of the street to the other, as has been done for many years. Something new is sought, one thing practically decided being a number of huge towers.

SALT LAKE CITY, UTAH.—The proposal made by the Utah Light & Railway Company to the commissioners of this city to furnish a blanket bond for electric signs to save the city harmless in case damages result from the signs falling or otherwise, has been rejected by the commission. They have decided instead to take out liability insurance on electric signs and charge the cost of the insurance against the sign owners. The commission reached this decision after carefully investigating the matter and concluded that the liability insurance would afford better protection at lower cost than the blanket bond.

TRANSMISSION.

SANDY, ORE.—The Portland Railway, Light & Power Company has agreed to furnish electrical energy if the city will build the necessary pole line from Bull Run.

NEW WESTMINSTER, B. C.—The city council has authorized extensions to the present street lighting system and additions to the city electrical equipment. This municipality operates its own street lighting and distribution systems.

VANCOUVER, B. C.—The Western Canada Power Company is arranging for a considerable amount of work in connection with its generating plant at Stave Falls as well as its distribution service. In July a 13,000 h.p. turbine from Switzerland is to be delivered.

LAS VEGAS, NEV.—Henry C. Schmidt and Clement H. Mace have filed a permit from the government for developing electric power amounting to 40,000 h.p. in Colorado River. Mr. Schmidt expects to be in Las Vegas in the near future to make preliminary arrangements for the work.

LA GRANDE, ORE.—A. Klees & Son, owners of the electric plant at Summerville, have reorganized as Klees Water Power Company, and have prepared plans and completed preliminary work for the erection of a larger central station, distributing system and auxiliary steam power plant.

SALEM, ORE.—The Rogue River Public Service has completed its filing on the water of Rogue River, at Hell's Gate for the development of 44,320 h.p. A 200 ft. dam is to be constructed. The power is to be used for pumping water for irrigation and for electric railroads and other commercial purposes.

VICTORIA, B. C.—Further additions to the Jordan River plant of the Vancouver Island Power Company will be commenced within a short time to provide for the third unit. This will bring the aggregate capacity of the plant to 25,000 h.p. The machinery is already on the ground and as soon as the building, which will cost $75,000, is complete the plant can be installed.

SAN FRANCISCO, CAL.—C. O. Poole, an engineer for the Southern Sierras Power Company, a subsidiary of the Nevada-California Power Company, has made three preliminary applications to the State Water Commission for water power permits on Baker Creek in Inyo county. The three projects contemplated are for the appropriation of 300 sec. ft. each and it is estimated that they will cost $400,000, $550,000 and $400,000 respectively.

OLYMPIA, WASH.—In a decision reversing the opinion of the superior court of Skagit county, the supreme court at Olympia has dismissed certain condemnation suits instituted by the Western Washington Power Company against land owners along the Baker River and tributaries. The court held that the testimony did not show sufficient cause for the exercise of the power to condemn private lands

for public purposes. As a result of the decision the plan to erect a big hydroelectric power plant in Skagit county will be temporarily halted. Attorneys for the Western Washington Power Company will prepare a motion for a rehearing of the case by the supreme court at Olympia.

TRANSPORTATION.

PASADENA, CAL.—Paul Shoup, president of the Pacific Electric Company, stated before the city commissioners that his company has under consideration the feasibility of electrifying the branch line of the Salt Lake line between Pasadena and Los Angeles, in an effort to improve car service

TACOMA, WASH.—The agreement reached by the city with the Tacoma Railway & Power Company for the operation of the tide flats car line has been signed by General Manager L. H. Bean for the company and Mayor Seymour for the city. The next step will be for the disposal of the $35,000 issue of bonds for the construction of the line.

WOODLAND, CAL.—H. R. Timm, treasurer of the Sacramento Valley Electric Railroad, has been informed that the contract for building the first unit of the road has been awarded to the Hughes Construction Company. The unit extends from the junction with the Oakland, Antioch & Eastern Railroad to this city, a distance of 11 miles. The next unit to be built will be from Dixon to Woodland.

PORTLAND, ORE.—Immediate completion of the Willamette Valley Southern Railway from Oregon City via Beaver Creek, Mulino and Molalla to Mount Angel and the actual operation of the road before the end of the present year was assured a few days ago when the Portland Railway, Light & Power Company agreed to guarantee a $700,000 bond issue necessary to finance the project.

POCATELLO, IDAHO.—J. D. Browning, representing an Eastern syndicate, states that work is to be commenced with as little delay as possible on construction of the street railway in Pocatello, the city council having granted the franchise. The system provides lines for the principal streets and use of a viaduct now in existence and owing to terms imposed by the public utilities commission there can be no delay or stock speculation in the project.

PASADENA, CAL.—At a special meeting of the Pasadena Realty Board, City Commissioners Metcalf and Salisbury asked the board to unite with other civic organizations of Pasadena in appointing a joint committee to consider plans for a municipal electric railway between Pasadena and Los Angeles, that have been drawn by D. J. MacPherson, There were references to a possible issue of $2,000,000 in bonds by the city. The realty board will co-operate with the city commissioners.

GLOBE, ARIZ.—Globe and Miami will be connected with an electric interurban line before the end of the coming summer, according to predictions made by D. O. De Tar, who has been working quietly on a project for several months. The line is to be built by local capital. A franchise for the use of streets here has been asked and will be voted upon at the coming city election. No stock in the company will be sold until the franchise is granted or until $75,000 worth of shares and $100,000 bonds are pledged.

OGDEN, UTAH.—Construction work on those sections of the proposed route of the extension of the Ogden Rapid Transit Company's interurban line north from Bingham City, Utah, to Preston, Idaho, where rights have been obtained, will begin within the next two weeks, according to P. D. Kline, general manager of the company. He is stated to have said that right of way had been obtained for the roadbed between Logan and Wellsville and between Logan and Richmond. The company has decided not to use the Ogden canyon route. The route that has practically been settled upon, Mr. Kline said, would parallel the Oregon Short Line tracks for the greater part of the distance. The difficulties in getting rights of way have been encountered between Wellsville and Brigham City, he said, but agents of the company are now working along that part of the proposed route. Rapid Transit officials say they expect to complete the entire extension within two years.

SAN FRANCISCO, CAL.—The city engineer has reported that the proposed construction of an extension on Stockton street from Columbus avenue to the Embarcadero, for the purpose of affording railway service to the passenger piers which the harbor commission is about to build on the northern waterfront would cost $68,000 and would involve going over a grade of more than 12 per cent between Chestnut and Francisco streets, and that this grade was too steep for the safe operation of ordinary street cars equipped with air brakes.

BURNS, ORE.—A meeting was held in Drewsey recently for the purpose of promoting an electric railway from Riverside up the Malheur Pass Drewsey, to tap the timber belt near Logan Valley. A permanent organization was formed with the following officers elected: J. L. Sitz, president; I. M. Davis, vice-president; W. D. Baker, secretary; C. W. Drinkwater, treasurer. A committee of finance was formed consisting of J. Edwin Johnson, E. B. Dunton, and John Ott. Steps will now be taken to interest capital in the building of this road. The organization will be known as the Malheur Valley Electric Railway Company.

SALT LAKE CITY.—The county commissioners of Salt Lake county have granted a franchise to the Utah Light & Railway Company for two important extensions of their interurban system which the company officials state will be built during the present year. One of these extensions will be from the terminus of the present Holliday interurban line to the company's power station located in Big Cottonwood Canyon. This canyon is one of the most picturesque of the Wasatch Range, and it is expected that much tourist and summer resident travel will be developed. The other extension will be from the terminus of the company's Wandamere line south to Fourteenth South and thence west approximately one mile to connect with the present Murray, Sandy and Midvale interurban line.

TELEPHONE AND TELEGRAPH.

NEWPORT BEACH, CAL.—The board of trustees will receive bids up to May 4th for a certain franchise granting the right to construct and maintain a telephone and telegraph system here.

SAN DIEGO, CAL.—An application for a franchise has been filed by the Pacific Telephone & Telegraph Company. The company proposes to allow the city the use of its poles and conduits for wires for police and fire alarm systems.

PORTLAND, ORE.—The socalled telephone trust, by which the Bell system dominates the lines of Washington, Oregon and Idaho, was dissolved without a fight here when a decree accepted by the telephone interests and conceding the government's demand was entered in the Federal court. The decree adds another state in the peaceful reorganization and makes specific plans for the restoration of competitive conditions in the Pacific Northwest. It ends the suit under the Sherman anti-trust law, brought here last July by the attorney general. In compliance with its terms the Bell Company will give up its holdings in the Northwestern Telephone Company, with lines from Port Angeles, Wash., to Corvallis, Ore., and in the Interstate Telephone Company, with lines from Spokane, Wash., into Northern Idaho. The acquisition of these two long distance companies, the purchase of the Home Telephone Company of Spokane, and of exchanges competing with the Bell in Seattle, Tacoma and Bellingham, Wash., contributed to the alleged combination in restraint of trade which led to the suit.

SAN FRANCISCO
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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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VOL. XXXII NO. 15 SAN FRANCISCO, APRIL 11, 1914 PER COPY, 25 CENTS

AN ELECTRICALLY EQUIPPED HIGH SCHOOL.
BY BARRY DIBBLE.

IS UNDERWRITERS' INSPECTION NECESSARY IN OREGON?
BY F. D. WEBER.

SOME P. P. I. E. LIGHTING DETAILS.
BY J. W. GOSLING.

A REPLY TO MAX THELEN.
BY H. S. COOPER.

CO-OPERATION IN PUBLICITY.
BY WM. WOODHEAD.

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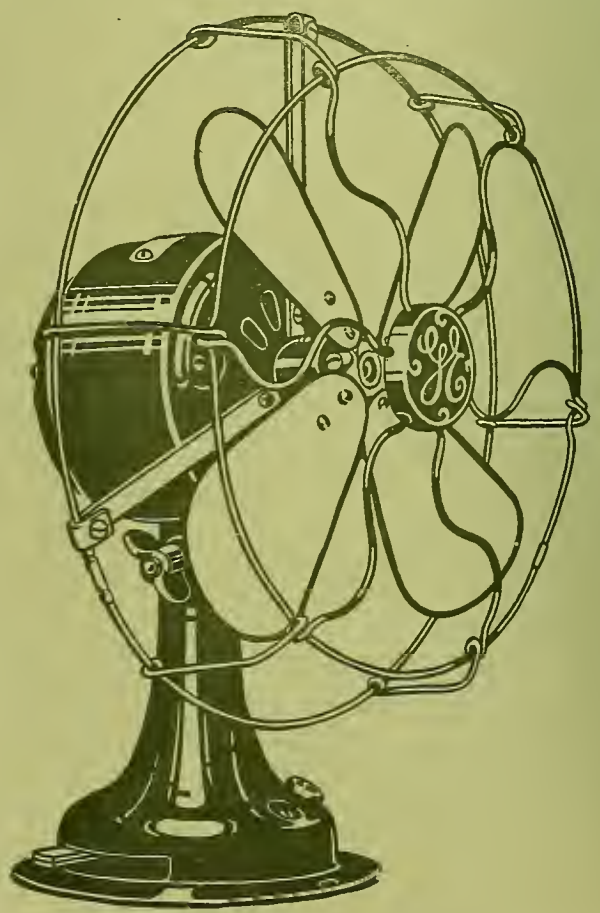
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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXII SAN FRANCISCO, APRIL 11, 1914 NUMBER 15

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AN ELECTRICALLY EQUIPPED HIGH SCHOOL

BY BARRY DIBBLE.

(In this article the author describes the complete heating equipment and the cooking and lighting load of a recently equipped High School building. Installation economies effected are stated and the cost of operation for one month also given. Mr. Dibble is an electrical engineer, United States Reclamation Service.—The Editors.)

The village of Rupert, Idaho, has recently completed a high school building which is unique for its electrical equipment. The building itself is a brick structure which is practically three stories high, designed to accommodate 600 children. The basement being nearly all above the ground level, is used for school purposes and is regarded as one story. It is occupied by the manual training, domestic science, sewing room, gymnasium and library. The transformers for supplying the building are located in a fire-proof ventilated room. Adjoining and under the main entrance are the heating equipment and the ventilating fan.

The main floor is used for class rooms and for the auditorium, which seats 500 people. The superintendent's office is immediately over the transformer room, and in it is located the control for the main line switch into the building and the panel for the heating plant. On the upper floor are more class rooms, the chemistry and physics laboratory and the lavatories.

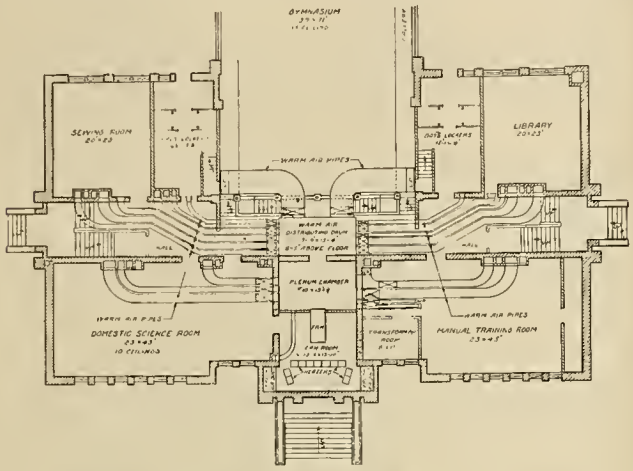
The present electrical installation in the building exceeds 435 kw. and provision has been made for the addition of further appliances as soon as they become necessary. The principal current consuming device is the heater installation for the building which has a connected capacity of 400 kw. This plant consists of eleven units, each having a capacity of approximately 36.5 kw. on 440 volts. Each unit is a stack of grid resistances as shown in the accompanying halftone.

Air reaches these heaters through down-chutes which take air through two-way dampers either from inside the building or from outside as desired. The fan is installed beyond the heaters and forces the hot air into the plenum chamber with a pressure of ¾ in. of water. From the plenum chamber galvanized iron ducts distribute the hot air to brick flues and thence to the various rooms in the building. Foul air is exhausted from each room through ventilating shafts leading to the roof. The fan has a capacity of 20,000 cu. ft. of air per minute or sufficient to change all the



Electric Cooking in a Domestic Science Room at Rupert High School.

air in the building every fifteen minutes. The distribution of air through the ducts is controlled by dampers. The floor of the plenum chamber has been dropped eight inches below the floor of the remainder of the basement and is flooded with water, across the surface of which the air is blown by the fan. Forty gallons of water evaporate from this pit each day and this has a marked effect upon the condition of the

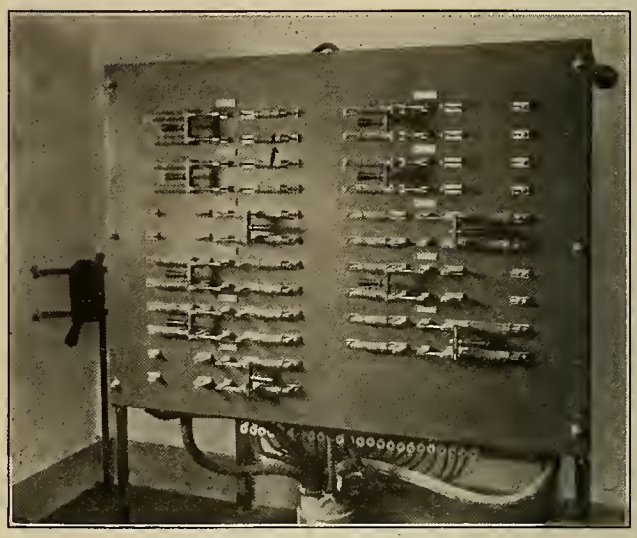


Basement Plan Showing Heating and Ventilating System Layout.

atmosphere in the building. Before use was made of this pit all the furniture in the building was shrinking and loosening at the joints, but this difficulty was immediately overcome when moist air was supplied. The increased humidity also makes the rooms much more comfortable for the pupils.

Power is supplied to the building through an underground cable at 3800 volts on a four-wire, three-phase system. The transformer room is located next to the heater room and immediately below the superintendent's office. It is a fire-proof chamber approved by the underwriters and ventilated through windows to the outside air. As the heaviest load on the main transformer will occur when the weather is coldest, the excellent ventilation provided has the effect of giving the transformer a large overload capacity at the time it is needed. A 15 kw. transformer is provided for lights and small appliances. The main transformer has a capacity of 300 kw., three-phase, and is of the oil-cooled type. Taps are brought out from the secondary side for both 440 and 220 volt, three-phase connections. These leads are carried to the panel in the superintendent's office, from which the eleven sections of the main heater are controlled with double-throw switches. Each section independently can be connected to either the 440 or 220 volt leads, and thus can be made to use either 36.5 kw. or one-fourth that amount.

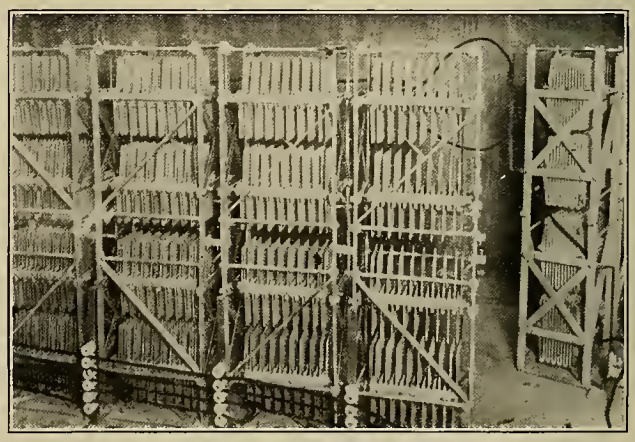
Power is supplied for this electric heater at a flat rate of $1 per kw. per month, based on the maximum demand for the month, with the stipulation that the maximum demand for the season must be paid for at least four months during the year. The normal operation of the heaters is as follows: At night the fan is shut down and the doors of the plenum chamber and of the rooms in the building are opened and all the units are switched on to 220 volt transformer taps. The fresh air duct is also closed and the air allowed to circulate through the building by natural draft. In this way the building is kept comfortably warm all night. In the morning the janitor starts the fan at about 7:30 or 8:00 o'clock, throws such of the units as he thinks necessary on to the 440 volt transformer taps and circulates air until the building is warmed to approximately 70 degrees F. This point should



Switchboard Controlling Heaters.

be reached by 9:00 o'clock or shortly after. As soon as the building is warm the fresh air duct is opened and the recirculating damper closed, a two-way damper being used for this purpose so that one register is closed when the other opens. As the day progresses and the outdoor temperature rises, heat supplied is gradually decreased by throwing the sections back to the 220 volt side.

The heating installation is designed to heat 20,000 cu. ft. of air per minute from zero to 70 degrees F., as this amount of air is sufficient to ventilate the building when it is occupied to its full capacity of 600 pupils and as only approximately one-half of this



One-half of Electric Heater Installation, Rupert High School.

number are at present quartered in the building it has been possible to keep the air fresh and warm and at the same time cut down on the heat required. With the thermometer standing two below zero the building has been heated and maintained comfortable with

268 kw. in use. To prevent excessive use of current by the janitor the fuses are removed from the 440 volt side of such sections as experience shows are not needed. In this way the panel is made to act as a demand meter.

Control of the ventilation can be had either by mixing air from the inside of the building with the outside air by means of the two-way damper previously referred to, or by charging the speed of the fan through the variable speed motor which drives it.

Wyoming bituminous coal costs approximately $6.25 per ton wholesale in Rupert and probably 160 tons, amounting to $1000, would be needed to heat such a building for one winter in this climate. The building has been in use only since January, 1914, so that exact figures cannot be given, but it is estimated that it will cost from $1500 to $1800 per year for electricity for heating purposes. In deciding upon this installation, however, consideration was had of the saving of over $3000 on plant cost which was made possible by putting in an electric heater instead of steam boilers and also of the saving in space which made available a room which will be used for a library. This room is 20x23 ft. and has a value of $2000, based on the entire cost of the building. The bond issue by which money was raised to construct this building bears 6 per cent interest, so that the saving in interest alone on these two items amounts to $300 per annum. A 10 per cent charge for depreciation on the excess cost of the steam installation would amount to another $300. In addition it would have been necessary to employ a fireman for the steam plant at $75 per month during the winter, so that a material saving in dollars and cents can readily be shown for the electric plant, even though the cost of power is in excess of the cost of coal. In addition to the considerations mentioned is the added value of the basement rooms because of the absence of coal with the accompanying dust and dirt, the avoidance of the noise of coal handling in the vicinity of the building and the saving in coal storage room. In addition also the building will need much less frequent redecorating and general cleaning than it would if coal were used.

The flat rate made for electricity for heating makes it possible to use the building in the evenings for meetings without any additional expense for fuel, and it is planned to make this school a social center available at all times for public gatherings.

Excellent use is made of electricity in the domestic science department which has a complete equipment of individual electric hot plates for twenty pupils. Eighteen of these plates are 4½ in. dia. and 250 watt capacity, and two are 8 in. and 735 watt. A complete electric range is also to be installed for lessons in baking and to enable the domestic science class to cook large menus for supplying the cafeteria.

Rupert is a town of about 900 population in the center of a farming community. The school district extends several miles in each direction and pupils are brought in daily with school wagons. It is therefore very desirable that means be provided for furnishing hot lunches to these country children, and by operating the cafeteria in connection with the domestic science department this need is supplied and older girls are at the same time given good practical experience. The electric equipment is particularly valuable for this use as a positive control can be exercised and there is less danger of the food being spoiled by the inexperienced cooks.

For the chemical laboratory a water still which consumes 1000 watts has been made by the pupils in the school. In addition to furnishing all the distilled water needed by the laboratory, the school is also distilling water for the local drug stores and exchanging it for chemicals. Electric hot plates are used for evaporators and other purposes. The pupils are making their own test tub heaters and other small appliances as uses develop for them.

Water for the entire building is heated by a three kilowatt circulating heater connected to a 250 gal. hot water tank located in the plenum chamber. This heater is left in circuit continuously and supplies hot water not only for the toilets but for the shower baths in connection with the gymnasium, for dish washing in the domestic science department and for laboratory purposes.



Rupert High School.

The machinery in the manual training room is operated from the 10 h.p. variable speed motor which drives the ventilating fan. About 8000 watts in Mazda lamps are used in lighting the building and in addition a 4500 watt stereopticon lantern is available.

Power for the month of February, 1914, was supplied as follows:

Heating, maximum demand 268 kw. at $1.00	$268.00
Lighting, 107 kw.-hr. at 6 1-3c (ave.)	6.76
Water heating, 946 kw.-hr. at .77c (ave.)	7.27
Power, 526 kw.-hr. at 1.6c (ave.)	8.40
Cooking and laboratory appliances, 48 kw.-hr. at 7c (ave.)	3.25
Total for month	$293.68

The entire installation is operating with marked success and to the entire satisfaction of all those interested. The equipment and wiring were installed throughout the building by the Rupert Electric Company. The heaters, controlling switchboard and principal appliances, were furnished by the Simplex Electric Heating Company Power for supplying the building is transmitted to Rupert from the power plant of the United States government near Minidoka, Idaho. The low heating rates are made possible by the fact that the 10,000 h.p. plant was primarily installed for pumping water during the summer for irrigating a 48,000 acre tract of bench land. Heating is therefore an off-peak load which can be obtained in large units and economically handled at a low rate.

ELECTRICAL CONTRACTORS' DEPARTMENT

IS UNDERWRITERS' INSPECTION NECESSARY IN OREGON?

BY F. D. WEBER.

(In this series the author traces historically fires and fire losses, refers to these statistically, to electrical fires in particular, and to the methods followed for their prevention. Though dealing with the State of Oregon more especially, the articles should prove of wide general interest and application. Mr. Weber is electrical inspector, Underwriters' Equitable Rating Bureau, Portland, Oregon, in which city the author presented this series before the local sections, A. I. E. E. and N. E. L. A. on April 7, 1914.—The Editors.)

The subject of my paper is put in the form of an interrogation. If what I can present to you for your consideration will cause you to answer the question affirmatively, I shall think my efforts well spent.

Referring to the "Insurance Year-Book," published by "The Spectator Company," 135 Williams Street, New York, we find that there were 341 Stock Fire Insurance Companies and 280 Mutual Fire Companies doing business in the United States, January 1, 1913. This does not include 500 small local mutual companies in towns and counties. The total value of risks written during the year was approximately $50,000,000,000.

The number of Fire Insurance Companies doing business in Oregon in the year 1910 was 92, the insurance in effect being $211,218,707. The number of insurance companies doing business in Oregon in the year 1911 was 95, the insurance in effect being $186,262,168. In the year 1912, there were 108 fire insurance companies doing business in Oregon, the insurance being $193,883.091. The figures for 1910 and 1911 do not include marine or automobile insurance companies, and the large amount shown in 1910 is due to writing a new form of policy, which allowed a policy to be written for three years on a risk for twice the annual premium.

"Modern fire insurance had its origin in London, England. London, like all other great cities of the world, was subject to destructive conflagrations. It was "nearly destroyed" by fire in 798. Again in 982 the "greater part of it" was burned and a century later, in 1086, "all the houses and churches from the East to the West gate" were swept away. In 1212 the "greater part of the city" was burned. The "Great Fire" of history, however, began on September 2, 1666, and burned for three days. When it had burned itself out, the buildings on 436 acres had been consumed. There were 13,200 buildings destroyed, including St. Paul's Church, eighty-six parish churches, the Guild House, Royal Exchange, Custom House, hospitals, libraries, fifty-two company halls, and all the principal public buildings and fine residences."

It is important to observe that as no part of the world is, so also no part of this country has been, exempt from these destroying fires. From Maine to Florida on the Atlantic Coast, the Pacific Coast, the inland cities as well as the ports—all have suffered in relative degree. All sorts of cities seem equally subject to conflagration. The flimsy "shanty" town of Virginia City, the wood-built city of Jacksonville, Fla., suffered no worse than the brick, stone and steel-built cities of Baltimore, Patterson and Toronto.

In the United States, since the government was established and up to 1906, there have been no less than 194 conflagrations and large fires, in each of which the losses were over $1,000,000. The total losses on these amount to $889,000,000. The principal ones in which the loss as estimated was $5,000,000 or over were as follows:

Important Conflagration Losses.

Date.	Place.	Property Loss.
1835.	New York City	$ 15,000,000
1851.	San Francisco	13,000,000
1861.	Charleston, S. C.	10,000,000
1866.	Portland, Me.	10,000,000
1871.	Chicago	168,000,000
1872.	Boston	75,000,000
1875.	Virginia City, Nev.	7,500,000
1889.	Seattle, Wash.	5,000,000
1889.	Spokane, Wash.	6,000,000
1889.	Boston "Bedford Fire"	6,000,000
1889.	Lynn, Mass.	5,000,000
1892.	Milwaukee	6,000,000
1900.	Hoboken, N. J.	5,500,000
1901.	Jacksonville, Fla.	11,000,000
1902.	Patterson, N. J.	7,000,000
1904.	Baltimore	50,000,000
1905.	New Orleans	5,000,000
1906.	San Francisco	350,000,000

The fire loss in the United States and Canada for a period of 37 years reaches the sum of $5,631,389,675, or an average of $152,199,721 per annum. The loss in 1913 was $204,723,350.

The 1914 World's Almanac estimates the population of continental United States at 97,000,000 for 1913, therefore, the per capita fire loss was $2.11. The per capita loss in Oregon in the year 1910 (population 600,000) was $1.97, in 1911 (population 650,000) $2.20, and in 1912 (population 700,000), $2.01.

TABLE I.

Fire Loss, National Wealth and Population of the United States for Thirty-Seven Years.

Year.	Fire Loss.	Nat. Wealth.	Population.
1875	78,102,285	30,068,518,507 (1870)	44,357,077 (Estimated)
1876	64,630,600		
1877	68,265,800		
1878	64,315,900		
1879	77,703,700		
1880	74,643,400	43,642,000,000	50,155,783
1881	81,280,900		
1882	84,505,024		
1883	100,149,228		
1884	110,008,611		
1885	102,818,796		
1886	104,924,750		
1887	120,283,055		
1888	110,885,665		
1889	123,046,833		
1890	108,993,792	65,037,091,197	62,622,250
1891	143,764,967		
1892	151,516,098		
1893	167,544,370		
1894	140,006,484		
1895	142,110,233		
1896	118,737,420		
1897	116,354,575		
1898	130,593,905		
1899	153,597,830		
1900	100,929,805	88,517,306,000	75,994,575
1901	165,817,810		
1902	161,488,355		
1903	145,302,155		
1904	229,198,000		
1905	165,221,650		
1906	518,611,800		
1907	215,084,209		
1908	217,885,850		
1909	188,705,150		
1910	214,003,300	120,000,000,000	91,972,266
1911	217,009,575		
1912	206,438,900	130,000,000,000	
1913			97,000,000

For the purpose of plotting, average values are computed for Fire Loss, National Wealth, Population, Per Capita Loss and Fire Loss per $1000 of National

Wealth based on the above statistics covering the conditions in the U. S. for the past 37 years.

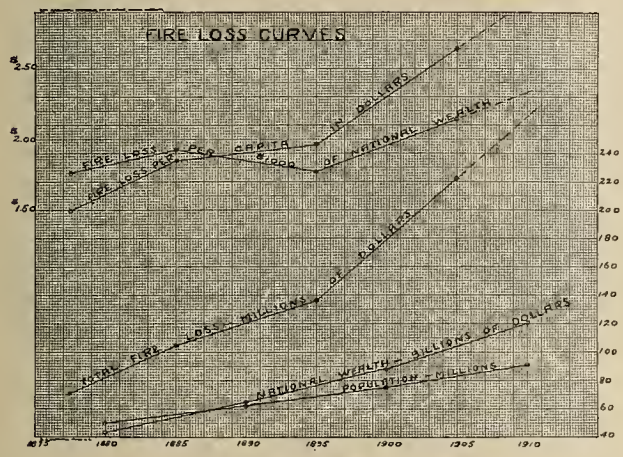
TABLE 2.

Years.	Average Fire Loss.	Average Nat. Wealth.	Average Population.	Fire Loss Per per Cap.	Fire Loss per $1000 of Nat. Wealth.
1875 to 1881.	71,276,947	40,248,629,626	47,256,430	1.50	1.76
1881 to 1891.	104,689,665	54,339,545,598	56,389,016	1.85	1.92
1891 to 1901.	136,515,568	76,777,198,598	69,308,412	1.96	1.77
1901 to 1911.	222,131,827	104,258,653,000	83,983,420	2.64	2.14

Now by plotting these values we can obtain five curves. The rate of increase of the fire loss is more than the increase of national wealth and very much faster than the population.

Fire Loss Curves.

The average "fire loss" is plotted to smooth out irregularities. Actual population being plotted according to U. S. Census. Average values are also used to plot "Per Capita Loss" and Fire Loss per $1000 of national wealth.



Average Fire Loss Curves.

When we take into account also the wages and business loss in connection with the $204,000,000 fire loss, this loss is brought up to $500,000,000 at least.

In addition to this annual fire loss, we must also consider the cost of the fire department in the United States which keep the fire loss down notwithstanding its present tremendous amount. It is estimated by the Encyclopedia of Fire Protection and Insurance 1913 edition, that the annual cost of maintaining fire departments, fire fighting apparatus, high pressure water systems and city and private efforts at stopping fire when it has once started is approximately $300,000,000 per annum.

The cash premiums received during the year 1912 was $371,626,991. Losses paid $190,073,164.

This would show $181,553,827 profit but we find that the total disbursements were $359,338,979, leaving a profit of only $32,526,977 to be divided among all the 621 companies doing business. This will show not more than a 5 per cent profit on the investment and coincides with the statistics on the subject which shows that four out of every five insurance companies which have transacted business in the United States have either failed or retired from business.

Now making a summary for the year 1912, to find the actual tax on the people of the United States, we have:

Loss by fire direct	$204,000,000
Loss of business and wages	275,000,000
Maintenance cost of fire depts., apparatus, water supply and private efforts	300,000,000
Difference between premiums paid and loss paid	181,553,827
	$960,553,827

Per capita loss as near as we can arrive at is $9.90.

The cost of the fire department only, in Portland for year 1912, was $514,467.15.

The fire loss in the United States is far greater than in European countries where it is about 1/4 to 1/7 and the cost of fire department bears even a lower ratio of cost. Therefore, we have won the title of the "United States of Destruction." It has been estimated by various authorities that at least 90 per cent of this fire loss is preventable.

The following physical and social conditions exist:

First: Differences in the view-point and in the civic responsibility of the individual in the United States and in Europe, and the consequent laws or regulations which govern the individual.

Second: Differences in general character of buildings outside of congested areas.

Third: Differences in thoroughness of construction and maintenance.

Fourth. Differences in regulations and their enforcement regarding especially hazardous materials and conditions.

The first difference enumerated being the one which has been acknowledged to have caused 90 per cent of the losses in the United States, is the one which the least attention is paid in this country. Consequently, if we do not have the fires, it is unnecessary to maintain such expensive fire departments.

In order to show the various causes of fires in the United States, it is instructive to take the record of an American city such as Boston, which would be more or less typical of the United States.

This city is selected because the records are more accurate and complete than in most other cities.

Causes of Fires in Boston from 1881 to 1905.

Causes.	1881.	1905.	Totals 1881 to 1905.	Per-centages.
Ashes, wooden receptacles hot	7	51	457	1.48
Buildings, defective	23	40	799	2.58
Causes not enumerated	102	569	6046	19.56
Combustion, spontaneous	17	26	875	2.83
Electricity	0	47	596	1.93
Fireworks	7	23	594	1.93
Gas	28	71	1337	4.32
Incendiary, supposed	48	95	1226	4
Kerosene oil	36	146	3156	10.21
Matches	65	275	4237	13.71
Needless	53	202	3101	10
Overheating	26	108	1597	5.17
Sparks	31	88	1777	5.75
Unknown	65	538	4347	14.06
Vapors igniting	7	26	412	1.33
Water pipes, attempt to thaw	6	15	355	1.14
Total	521	2320	30,912	100%

It is probable that a portion of the "Unknown" and "Causes not Enumerated" fires, may be electrical, consequently from 5 to 15 per cent of the fires in the United States are considered electrical.

(To be continued.)

The total annual rainfall upon all land according to an estimate by Sir John Murray, amounts to 29,347.4 cu. miles, and of this quantity 6,524 cu. miles drains off through rivers to the sea. A cubic mile of river water weighs, approximately, 4,205,650,000 tons, and carries in solution, on the average, about 420,000 tons of foreign matter. In all, about 2,735,000,000 tons of solid substances are thus carried annually to the ocean.—United States Geological Survey.

LIGHTING METHODS



The Forty-eight Searchlight Scintillator for Spectacular Lighting, P. P. I. E.

SOME P. P. I. E. LIGHTING DETAILS.

BY J. W. GOSLING.

(These further details of proposed lighting effects at the Panama-Pacific International Exposition, San Francisco, 1915, are abstracted from a paper read by Mr. Gosling before the San Francisco Architectural Club, March 24, 1914.—The Editors.)

This article will not deal with costs or maintenance but will be devoted to ornamental and decorative aspects of the illumination planned.

In the main group of buildings the lights which are placed back of the windows will in part act also as a general source of illumination to take care of janitor service.

All windows in the exposition will be equipped with lamps intended to cast an even bright, warm illumination through them, so that when the exposition is seen from the hills it will have a generally gay, pleasing and hospitable aspect, much resembling a great building during a gala occasion. In many cases the lamps will be colored.

Festival Hall, besides its great auditorium, contains a number of small conference rooms, halls and passages of old form. Most of these conference rooms and halls have low ceilings and are lighted by semi-indirect lighting units, which are made of plaster and have a glass bowl set in them for direct diffusion of the light. The plaster is in a somewhat decorative bowl form, and although it is ornamental, it is quite inexpensive. The entrance halls and foyer will be lighted by large suspended fixtures composed of a dish of leaded glass, something in the form of the Greek amphora. It is intended that these fixtures will give warm, even illumination throughout the entrances. The vestibules will be equipped with a rather ornate lantern similar to that which will light the colonnades of the Court of Flowers. The auditorium is lighted by both indirect and direct light. Indirect illumination is obtained by the use of searchlights which are set in a well under the center of the room, the light being sent upwards through a diffusing plate on the well-head. This well-head is about four feet in diameter and on a level with the backs of the seats. It is estimated that the twelve 18 in. projectors used for this work will give a general even illumination upon the interior of the dome which reflecting the light downward will give an illumination of about 1.5 ft. candles at the floor.

In order to offset any effect of the flatness or coldness generally derived from indirect light, there will be suspended six large ornamental ball type fixtures in the arches over the balcony as well as 12 well fixtures placed around the corridors at the rear of the balcony. These fixtures will be composed of glass work which will give off a warm, soft, mellow light and will be kept out of the direct range of vision of anyone watching the stage, although none of them is so intense or brilliant as to tire the eyes.

The stage, of course, is equipped with the usual foot-lights, spot-lights and orchestra lights.

California Building.—The style of architecture of this has been the means of developing a number of lighting devices which will be somewhat out of the ordinary, the principal ones of these being the great ring of candles in the foyer, the spheres of light which will illuminate the body of the ball room, the method of lighting the dining room of the president of the exposition and the lanterns which glow at all the principal entrances. The arcades are lighted by small lanterns and the forecourt by many tiny lanterns strung through and about the trees and hedges. The oval entrance stairways will have newels composed of three figures, each bearing luminous glass balls. In the president's dining room there is a ceiling panel about 12 in. square, above which there is a sky-light; suspended beneath this sky-light will be a silk shawl or curtain through which there will pass the light for illuminating the room. The many rooms in this building will most of them be treated differently from an illuminating standpoint, although all the fixtures will be of Mission style. Surrounding the building will be a row of standards in Mission style, each having as a light source an arc enclosed in an iron lantern. The lantern is equipped with light diffusing glass on the side toward the building and with very dense glass on the opposite side.

The Court of the Universe being the most important of the courts and one of odd form and dimension presents some very unique problems in illumination. The main source of light will be placed in the two large fountains at either end of the sunken garden. The part giving the light is in the form of a column in the center of each fountain and in this will be seen the first installation of the latest development in incandescent lighting. The columns are of heavy diffusing glass, about 38 ft. high and 5 ft. in diameter, each containing ninety-six 2500 c.p. nitrogen lamps. It is calculated that there will be a generally even light on the face of the peristyle of about 3 ft. candles.

In this court there is also a number of small sources of light, none of them intense, but being placed to accentuate the elliptical form of the sunken garden and act as a means of adding an appearance of festivity and brilliance to the court, to draw the eye from the brighter fountain light, and relieve the space between the fountain and the columns from any effort of monotony. On the back of each column set in a flute will be three glass bowls each containing a lamp which will shed a warm light over the arcade and tend to wipe out any objectionable shadows which might be cast by the main lighting source.

It is in this court that we have the great ring of figures bearing stars of jewels. In the base of each figure is placed a projector, not visible from below, but casting a beam of light across the court and shining on the star of a figure on the opposite side.

The Court of the Four Seasons will have a light of a different color. By this is not meant that the color will be different in the sense that yellow is different from red, but in the sense that the light of the arc is quite different from that of the incandescent lamp. About the fountain in the center of the court, midway between it and the colonnade, will be ranged eight standards, each having two ornamental luminous arcs and the approach will also be equipped with this same standard. These standards will be so placed that the light of the arcs will fall full upon the building and be shielded on the side away from the building. The shields on these standards are in the form of a decorative figure bearing garlands of flowers.

The Court of Abundance with its unique architectural treatment has suggested many lighting effects which will strike the visitor with surprise as he enters the court. The basin in the center has at one end of it a fountain which is in the form of a globe surrounded by figures, and so arranged that the upper half of the globe will remain exposed. The globe, though 18 ft. in diameter, will be built of glass and contain a mechanical arrangement of light which will give the globe the effect of turning as the earth does upon its axis. Streams of water will pour upon and over it, while about the sides will issue steam in slow rising whirls, giving the whole the effect of the planet of the earth turning in space. At the opposite end of the pool and a part of the sculptural composition will be the Sun, setting at the water's edge. The Sun will be formed of a disc of plate glass about six feet in diameter, and have arranged behind it a mass of small incandescent projectors driving a powerful light upon the earth at the further end of the pool. By the use of colored shutters the Sun will be given that effect of tremulous movement it sometimes has as it sinks through the denser atmosphere close to the horizon.

At the end of the pool and flanking the fountain of the Earth, will be two great sunbursts of incandescent lamps. These are, in form, very much like a snow crystal and will face south, sending a warm light through the court, as the lamps, of which there are 435 in each burst, will be colored in all tints of yellow and orange.

Gas flambeaux are to be placed at intervals about the pool and will tend to break up that steady, evenness of the electric light, as the flames will wave in the breeze. To further give interest to the illumination by gas, into the gas flames will be occasionally introduced berium, sodium, stantium, and other salts which will cause the gas to flare up in variegated colors.

The cloisters surrounding the court are lighted by small lanterns, as well as by the rays of searchlights placed above the cornice lines. These searchlights will be fitted with wide angle doors, flooding the cascades with radiance.

The north approach to the Court of Abundance will be lighted by four of the same sunburst as used in the inner court and also have many gas flambeaux, cloister lanterns and steam caldrons.

The Palace of Fine Arts lighting effects will be conducive to quiet, though mysterious and peaceful also. An effect of moonlight will be striven for to cover the lake, shrubbery and trees. Enough light will be centered upon the rotunda so that it may be seen in soft reflection in the water surrounding it. No lights will be visible here except an occasional firefly in the trees. This will be the spot to rest the eyes after viewing the brilliance of the scintillator display.

PUBLIC POLICY OF PUBLIC UTILITY CORPORATIONS

A REPLY TO MAX THELEN.

BY H. S. COOPER.

(In this discussion the author criticises adversely the fundamental relationship of Principal and Agent as that existing between the public and its utilities as advanced in the article on "A New Rate Making Basis," by Mr. Thelen, published in the Journal for November 22, 1913. Other articles on this issue also appeared in the Journal for December 27, 1913, and March 28, 1914.—The Editors.)

The Situation Stated.

Mr. Max Thelen's article on "A New Rate-making Basis" in your issue of November 22d is chiefly valuable on account of the fact that it brings into succinct form and explicit terms the utmost radical ideas on the subject of the relations between the public and its privately owned and operated utilities. These ideas have been floating hazily around for several years and Mr. Thelen has conferred a favor on the utilties by putting them into an official concrete shape and definitely stating the premises, the arguments and the conclusions.

I have said, intentionally, that he has "conferred a favor on the utilities" in doing this, for this article not only shows to what lengths mere theory may be prematurely forced into practice if given arbitrary authority and plenary power, but also because in thus assembling them in logical form he has shown their lack of correlation, or of sufficient correlation to establish the conclusions deduced.

The main weakness of Mr. Thelen's chain is in its first link and his first paragraphs, which are as follows:

> The fundamental relationship existing between the public and its public utilities is that of principal and agent. Out of this relationship logically should grow the proper basis for determining the rates which a public utility is entitled to charge. The state has the right to do for the public whatever is demanded for the public welfare, including the establishment and operation of enterprises of a public utility character. What the state can do itself it has the right to delegate to private corporations and persons to do for it.
>
> In carrying out the agency, the public has given to the public utilities the right to use the streets and highways and to take the property of private persons in the exercise of the power of eminent domain. These are tremendous powers which are conferred by the state only upon its agents in the prosecution of enterprises of a public or quasi-public character. In eminent domain proceedings the plaintiff must allege and prove that the use is a public use and that the plaintiff is in charge thereof. He can be in charge thereof only as the agent of the public to carry out powers exercised in behalf of the public as principal.

Without discussion of the truth or relevancy of these exceedingly important portions he reiterates his conclusions and their results according to his ideas. If these premises were fully and completely stated and if, upon such statement, they were found to be axioms, or absolutely proved conclusions from former theorems, there might be some basis for his conclusions but, being imperfect, incomplete and unproven, any conclusion based on them must, necessarily, be the same.

Delegate and Deputize Defined.

His first statement is "what the state can do for itself it has the right to delegate to private corporations or persons to do for it." This is true, but it is only true when the word "delegate" is used in its proper sense: "to intrust or commit." The difficulty with Mr. Thelen is that he uses that word as though it were "depute," whereas a "delegate" is one thing, a "deputy" is something entirely different and this difference is a very vital one. Only a chief or a sovereign may "delegate" an authority or a power; any subordinate or inferior may "deputize" either. "Delegation" presupposes the abstaining, by the delegator, from the use of that authority or power during the interval of delegation; "deputizing" means that the principal retains the right of use of the power during the interval of deputization. "Delegation" means the voluntary concurrence of both parties in the action; "deputization" means that the acceptance of the authority or power is compulsory on the deputizee merely by the will of the deputizor. A sheriff has authority "delegated" to him by the state because he has voluntarily requested that authority by becoming a candidate for the office and, while he remains sheriff and properly exercises that authority within its exact limits, the state cannot equitably annul, limit, or interfere with, that authority. But the sheriff may "deputize" that authority to any one within certain limits, the person so deputized is compelled to accept it and become a "deputy-sheriff" and the authority may be recalled at any moment or for any cause. In fine: the act of "delegation" is a mutual agreement with conditions binding on both parties; the act of "deputization" is not.

Mr. Thelen uses the word "delegate" in his premises but distorts it into "deputize" in his arguments. The state can and does "delegate" certain of its authority or power to certain public utilities but it always does so on certain conditions mutually agreed to between itself and its delegate and on a—supposedly—equitable basis; for a state, in a government "by the people," can, and must, be nothing but equitable in its dealings with the people or any portion of them, otherwise it becomes an autocracy instead of being a democracy.

Relationship of State to Public Utilities.

The state or "public." "delegates" authority or power to a voluntary "delegate" and for a mutual equivalent or a mutual benefit; the power or authority so delegated being the state's or public's contribution towards an enterprise that is to benefit it—an enterprise that it cannot, or will not, operate itself at the time. Under such conditions of the transaction, the relations of the state or public and its delegate are voluntarily mutual, and if those relations are anything at all they are those of co-laborers or co-partners. "Charters" and "franchises" are not merely permissive nor are they mandatory, they are, both of them, actual "agreements" between two willing contracting parties. The state or the municipality says, in effect, "if you will do such and such, we will do such and such" and the utility voluntarily accepts or rejects the proposition. This is so confessedly so that neither charter nor franchise have actual being unless or until the utility accepts them by voluntary word or act.

Object of Chartering or Franchising.

Unless plain words and actions mean nothing at all or unless they mean the absolute reverse of what they indicate, the desiring utility that accepts the stipulated authority as a necessary concomitant of its enterprise does so in the same spirit in which the offer of that authority is made. Neither by direction nor by implication has any charter or franchise ever contained a single word or expression that would indicate in any way that the object of it was an "agent." The whole object of the chartering or franchising has been to encourage private capital and efforts to enterprise in matters in which the state or the public was not willing to enter and it gave that encouragement in the form of such rights, privileges or authority to the utility as that utility could not, of itself, acquire, or exercise. It cuts no figure in this transaction that the projected enterprise may not even be a possibility without the power or authority so delegated, the mere necessity of a thing is not always a measure of either its absolute or even of its comparative value. A man may need exactly five hundred dollars to accomplish a certain object and may lack just one dollar of the amount and that one dollar may be obtainable from only one source, but it would be considered a most inequitable transaction if the furnisher of the lacking dollar shonld demand an equal or controlling interest in the enterprise because of his monopoly of the opportunity, and this would be especially the case if the dollar were useless to him nnless so given and if he were, otherwise, to be a beneficiary of the enterprise when

it was started, and no one would have the temerity to assert that, because of the addition of the lacking necessity, the party receiving it became an "agent."

Utility Operation Creates Values.

Yet the cases are identical. The powers and authority of the state or public delegated to certain public utilities are, when latent and not used, of absolutely no worth or value—not even of potential value—except to be delegated. To have a power over only oneself has no commercial or even intrinsic value, to be able to delegate that power or a portion of that power to others gives it a commercial value especially if the exercise of that power by others is a benefit to self. The inherent power of the state to build and operate its own utilities is merely a "static" power even when exercised, it only becomes "active" when it entrusts that power to others and, as the ability to delegate that power is absolutely a monopoly of the state or public, the arbitrary and inequitable use of that monopoly contravenes all principles of equity and makes the state violate a principle of morality and ethics the violation of which it punishes in any or all of its separate constituents.

Axioms Which Emphasize Limitations.

For there are several things that are axioms of morals, law and social economy that Mr. Thelen does not seem to realize, or, at any rate, does not seem to realize sufficiently to incorporate into either theory or practice. One of these is that "might does not make right"; the power and authority, even of a state, does not always give the "right" to do a thing within them. Another point that does not seem to be appreciated is that the "expedient"—simply as such—is, by the very fact of its being such, not the right thing to do. And another point, long since proven, but often disregarded, is that "the end never justifies the means."

Moreover, it must be remembered that the bolstering of a theory or practice by court decisions or the opinions of those who—as a matter of private opinion—are "great constructive statesman"—is a "leaning on a broken reed" and at a risk of a subsequent dangerous fall unless there is some firmer support of facts or principles. Tomorrow the official judicial opinion of one man out of a hundred millions of us, a judge of a court, may change the entire legal aspect of the case and, tomorrow, a further enlightenment of the "great constructive statesmen" may make them revise their ipse dixits.

It must also be remembered that there are other factors—and very powerful ones—in this case, that have to be given their full value in any just and equitable settlement of it. Mathematics are of great use in the final details but to base the conclusions largely on such is to give undue prominence to a minor factor. Even statistics are a two-edged sword and are to be used carefully and conscientiously and only as "proofs subject to later correction."

Justice, equity, a certain amount of liberality of act and opinion on each side, commercial common sense and an allowance for the "human nature that is in human beings" are much more vital and necessary factors in the proper settlement of this matter at the present time than are law, opinions, theories or mathematics.

Actual Exercise of the Power of Eminent Domain.

A prime requisite in ratiocinations of the character of the article by Mr. Thelen is that its premises, at least, should be of the same constituents as an oath; that they must consist of "the truth, the whole truth and nothing but the truth." Mr. Thelen states that "the public has given to the public utilities the right to use the streets and highways and to take the property of private persons in the exercise of the power of eminent domain." As a matter of fact and without further explanation and limitation—which is not given by Mr. Thelen—this is wholly untrue as regards many so-called public utilities, is partially untrue in regard to every one of them, and gives to those not fully cognizant of the facts a very wrong impression.

First: With reference to the use of the streets and highways—that which may be called the "franchise power" in distinction to the right of "eminent domain" which we may call the "charter power"—no public utility has the use of the streets and highways in the sense that they have the exclusive use of the streets and few of them have such use in the sense that that use deprives any one else of a proper or legal use of the same street or highway.

Gas and water utilities use only the under-surface of the streets and alleys and their use of them is always subject to the priority of municipal utilities such as sewers or water. In no way can they interfere with the free and untrammelled use of the streets or highways by the public and any disturbance of the surface of the street is always at the risk and expense of the private utility.

Utility and Private Occupancy of Public Property Compared.

Electric light and power conduit mains and services come also in the same category and it is only when it comes to aerial lines or to surface railway tracks that the actual street or highway is "used" in the sense indicated in Mr. Thelen's sentence, and a little consideration of the matter will show that, in most cases, the "use" is a very slight one as compared to the "tremendous" powers spoken of. As a matter of fact the location of poles or other means of carrying the aerial lines of wires is always and entirely under the authority of the public and is generally—and can always be made, without cost to the public—of the least danger, hindrance or obtrusiveness and is nearly always so made without regard to the expense to the utility. There is scarcely a town or city in the United States where the encumbrance to the sidewalks (the usual location of aerial line poles) by the private property owners is not much greater than that caused by the utility. Signs, hitching posts, awnings, coal chutes, gutters, ash and goods lifts, area openings, projecting steps—to say nothing of show-cases and other commercial and money making impediment—are the rule of private incumbrance on the business streets and far outnumber and outspace the poles of the utilities, and the same is true, in lesser kind and degree, of residence streets. If these aerial lines become either a real or fancied danger, or a source of distaste, dislike or displeasure to the public they are quickly displaced underground and, generally, without regard to the cost to the utility—but the incumbrances of the private property owners are still allowed. As a matter of fact the aerial line "use" of the streets consists simply of a toleration of it in as unencumbering a manner as can be forced on the utility and with an abolishing of it at the earliest opportunity to compel it. So much for one of the "tremendous" powers!

Electric Railway Use of Public Property.

As regards the rails of surface electric railways, their use is physically necessary on the surface of the street and in that sense there is a "use" of the street. But it must be remembered that they and their necessary appurtenances of overhead or underground trolley are merely the material evidences of such "use" and that the actual "use" (and abuse) of the streets by the private public is many times greater and of infinitely greater cost to the public as a whole. As a rule the railway is not only compelled, and often at unnecessary expense, to make its track a constituent, sane and unencumbering portion of the street but to pave and maintain the portion or portions of the streets "used" by it. And, it must be remembered that this is not for its exclusive use, the portion it momentarily occupies in the transit of its cars is used equally by the public; the heaviest beer-wagon or loaded truck of a private citizen or enterprise, or of any stranger—such as a circus—may use, and abuse, its track and the pavement for which it paid and for whose condition it is responsible. It is also bound by rigid ordinances, rules and regulations as to speeds, stops, etc., and, in some cases, even as to the character of vehicle or load that it may use or carry on its own rails. Should it be an "over-

head" trolley, its aerial property will be forced underground at the earliest opportunity for—like the aerial lines of the other electric utilities—its so-called "use"—the material evidences of that "use"—are merely tolerated as a necessity until it is possible, or expedient, to abolish them. So far as the "use" of the street by any surface electric railway is concerned that "use" is—merely considered as a private use for gain—of less danger, incumbrance, hindrance or discomfort to the public than the "use" by the public itself or many members of it. Even when the railway is given certain "privileges" by the public such as the "right of way" against ignorant or intentional delaying or hindering vehicles or persons, that "privilege" is not primarily to enable the utility to avoid loss of traffic but to aid in insuring the public a more rapid or more regular transit. So much for another of the "tremendous" powers!

Public Benefits from Utility Occupancy.

Summed up, the much vaunted "franchise privilege"—"tremendous powers" simmer down to a tolerance of the material evidences of "use" in their least objectionable form to the public, be that form at a loss to the utility or not. To listen to Mr. Thelen's premises a person unacquainted with the facts would naturally be led to think that the so-called "use and occupancy of the streets and highways" was a monopolization of them to the utter exclusion of use, or of necessary use, by the public, whereas "the truth, the whole truth and nothing but the truth" is that such "use and occupancy" is not only always a possible minimum on the part of the utility but facilitates the greater use of the street or highway by the public and lessens the expense of construction and maintenance to that public.

As regards the above statement that the "use" of any street or highway by a utility is always a "possible minimum," that is a self-proving fact; no utility would construct or maintain useless and expensive lines or tracks simply for the fun of paying the additional expense, nor, in these modern days, will it retain any antiquated, dangerous, unsightly or unnessarily encumbering apparatus, appliances, or fixtures if it is in any way financially able to displace them with better ones. The constant, and voluntary, improvements in these matters and things all over the country, even in the smaller cities, towns and villages, during the last few years, is unquestionable proof of this fact.

As regards the statement that the use and occupancy of the street by the utility facilities the greater use of that street by the public and lessens the expense of construction and maintenance of it, this also is a self-proven fact, if a little thought is given to the matter. If in any modern city or town the use of the aerial and underground lines and piping and the tracks of the railway were abolished, the streets could not contain the vehicles that would be necessary to take the place of these evidences of use of the utilities. To carry the necessary materials for light, heat and the delivery of water, and to carry the crowds who travel backwards and forwards, would necessitate a very much greater use of streets and sidewalks than at present, and this fact, together with the further one that the public utilities are generally compelled to bear more than their proportion of the costs of the occupancy and use of the streets and highways, bears out the statement made that such "use and occupancy" is directly of benefit to the public in these particulars.

The Power of Eminent Domain.

With reference to the "power of eminent domain" or, as it is better known, "the right of condemnation," the facts are that very few of the various classes of public utilities have this power or are able to obtain it even should necessity arise for its use. Until quite recent years this power was limited almost entirely to interstate transportation companies, such as steam railroads, canals, etc., and even at this date there are very few states that delegate such a power to other than transportation companies. As a matter of fact, I fail to remember at this time any state which allows this power to electric light and power or artificial gas companies, although some states have allowed it to natural gas companies and to water works, but only to a limited extent.

In reality this power is a very limited one. In the first place, it is a delegated authority and can only be used expressly for a particular purpose, and its use is so encompassed with specific limitations that it is virtually impossible for that use to ever become an abuse even in isolated cases. As a beginning it has to be proved that the condemnation is a "public necessity," that is to say, that the mere fact of saving the utility any expense or enabling it to make a profit is not considered at all as a warrant for condemnation, the whole plea for this must be that it is for the "benefit of the public." Also, the party whose property is thus condemned is given every facility in law for obtaining not only the intrinsic value of the property but also of being reimbursed for any collateral losses which may occur on account of the condemnation of the property. In addition to this the exact use to be made of the property is made a portion of the proceedings, and that use must be "for the benefit of the public." Also, in many states, this condemnation does not give ownership in fee simple but merely gives an equity in the property as long as it is used for the specific purpose for which it was condemned, and it has been adjudged in a great many cases that when used for other purposes, or when its original use terminates in any manner, that it reverts from the condemnor. It will be seen, therefore, that there is little opportunity of profit arising to the utility from the increase in value of such condemned property as it can generally only be used for the specific purpose for which it was condemned and can neither be rented nor sold nor used for other and more profitable purposes. Thus it will be seen that even this "tremendous power" shrinks to something rather small when it is viewed closely and honestly.

Franchises and Charters Explained.

These matters of franchise and charter powers have been greatly misunderstood by the public at large on account of the fact that the public, as a whole, has been ignorant of the true state of the case, and has also been greatly misinformed as to it by interested parties; the misinformation greatly exceeding the information and coming from sources which should know better and should be more strictly and exactly truthful in their statements.

The greatest factor that tends to diminish the "tremendousness" of both these powers is the fact that, primarily, they were not given with the entire idea of directly financially benefiting the utility The chief reason for these powers being delegated, or the facilities given, was for the direct benefit of the public—giving it a needed facility that it could not, or would not give to itself. In local manufacturing and distributing public utilities, such as water, gas, electric light and power and street railways, the public could not have had the benefit of these facilities unless the utilities were allowed the "use and occupancy" of the streets. To have granted a charter and franchise to any one of these utilities and then prevented them from reaching the general public with their distribution or transportation system would have been a rather grim joke on both the utility and the public. This is a phase of the case which seldom seems to strike the public; they hear of the "valuable privileges" given the utility in the use and occupancy of the streets and there floats hazily through their minds the idea that this is a gift for the sole benefit of the utility and that it is one in which the public has no share, and it is very seldom realized by the general public that this so-called "gift" was a necessity for their own benefit as much or more so than for the benefit of the utility.

As previously stated, these privileges are of no value whatever to the community except when they are delegated to private individuals, and in the making of the so-called "franchises" there is always an implied, if not an actual,

mutual benefit, and this has been made even stronger since the courts have virtually determined that there is legally no power in a community to give a monopoly of such privileges to any one party, nor to make those privileges perpetual. While it has been very recently found that it is a better public policy to allow a controlled monopoly of any one utility in any one community, this has been done for financial and operative reasons and not for legal or legislative ones.

It will be seen, therefore, by the above facts, that there is in the public mind—and even in the minds of those who should be better informed—a very erroneous idea as to the "tremendousness" of both the franchise and charter privileges heretofore and at present granted to public utilities. That, in isolated cases, there have been certain franchises and charters "granted," by which the community or the state did not receive any, or a proper, compensation or share in the advantages opened up by the agreement, does not affect the matter. The power has always been with the public, and if it has in instances in the past made a bad bargain, or if it has allowed the other party to break its agreement, that does not affect the principles involved in the matter, as the old legal maxim "caveat emptor!" ("let the buyer beware!") applies as equally to states and communities as it does to individuals. The fact that certain abuses have crept in on both sides in the granting of charters and franchises and in the operations of the utilities has nothing whatever to do with the equity of the granting of these powers when it is properly done and the agreements thereon fully carried out. It might just as well be said that there was something wrong with the laws forbidding stealing and murder simply because there are still thieves and murderers.

Original Cost as a Rate Making Basis.

Mr. Thelen goes on to state under his heading "Refutation of Objections" some matters to which few object and others about which there can be little dispute, although the reasons he gives in refutation are not always exact and correct. He states "that original cost," including betterments and additions, should not be used as a basis for utility rates for the reason that it is often difficult to ascertain original cost." He should also have stated that in a great many cases it is excessively easy to obtain original cost either on account of the fact that the property of the utility is quite a recently constructed one or that the records of some of the older ones have been perfectly kept from the very beginning, so that in at last fifty per cent, in number, of the utilities at present existing it is easily possible to arrive quite exactly at the original costs and betterments and additions. It is, therefore, a question, so far as this valuation is concerned, of obtaining the exact values of that fifty per cent, where it is obtainable, and averaging the others; or of abandoning the idea of using "original cost plus improvements" as a factor in the rate. Under the idea of Mr. Thelen that the utility is merely an agent of the public, the latter course would necessarily be suggested, but under the more reasonable and equitable idea of the utility being a "partner" of the public it is absolutely necessary that some attempt to obtain the physical value of the property be made if the basis of rates is to be a correct and equitable one. In every other business in the world the "capital invested"—be it tangible or intangible—is a factor of the profit and, consequently, of the costs. Just why a single class of commercial enterprises such as public utilities should not be judged or guided by accepted commercial standards is a matter that has never been explained except by "theories" and the probable reason for this is that there are no facts to back up an "explanation." At any rate, Mr. Thelen gives none.

Valuation of Real Estate.

The question raised by Mr. Thelen as to the valuation of the "real estate" of the property is one that seems to me is almost self-solving. In the matter of property that has been condemned, the very idea of condemnation, as heretofore stated, is that the utility, even although it has paid a very full price for that property, has only paid that price as an equity or long-term-rent for its use for a specific purpose, and that any accretion in value since its condemnation belongs either to the original owner, to whom it may finally revert, or to the public by whom the increase in value has been made. Of course, there are cases where the very fact of its use as a public utility property has added value since its condemnation, hut such an additional value would be very difficult to obtain. The equitable method would seem to be that the property should be considered as having been rented or leased for an indefinite term of years and that the original payment, plus the taxation, would be merely "rent" for the period it was used for the purpose for which it was condemned. With this equitable and just conception of the matter the utility would have no equity in the "value" of such property nor any interest in any increase or decrease of that value. To whom such value actually belongs is another matter entirely.

Public Utilities and the Unearned Increment.

Mr. Thelen tries to make a distinction between the right of a private citizen and the right of a utility to the "unearned increment"; that is to say, that the citizen may benefit from profits in which he had no hand in making, but that the utility may not do so even if it was a powerful factor in the making of the profit. Given that a private manufacturing or distributing concern may today equitably claim such a profit; tomorrow—it having been legislated or commissioned or adjudicated into a "public utility" over night—it instantly loses that right. In view of the fact that the "single tax" idea is making rapid headway, it would seem that Mr. Thelen's statement should be modified in accordance with that tendency. The paragraph in which Mr. Thelen gives the reason why a private citizen buying land is entitled to the unearned increment and that a public utility is not so entitled is not conclusive, for the reason that Mr. Thelen again falls back on his "agent" theory to prove it. In reality, the two cases are similar, but not on account of the reasons given by Mr. Thelen. The tendency at this moment with reference to the unearned increment is somewhat in accordance with Mr. George's "single tax theory" and is being strongly and practically manifested in the various systems of taxation and valuation of real estate that are now being applied all over the world. The method of obtaining ownership in fee simple has nothing whatever to do with the case unless it was explicitly understood, agreed and recorded in the original transaction. To vitiate the terms of any agreement made in good faith and in conformance with the then existing law, is an action that only the sternest public necessity will excuse, and up to the very present moment there has never been any idea that the absolute bona fide fee simple ownership of land by a public utility was not identical with the same ownership by any private citizen, and no fallacious theories nor arbitrary reasoning at this time, nor any action of the public, will make such a vitiation right, just or equitable. If in any particular community the right of all private citizens to the unearned increment is assailed or taken away by the public, then the utility, as one of the citizens, should go into the same category, but to make a distinction of this character where the original transaction was identical and made in good faith by all parties concerned, is, virtually, confiscation, and not in accord with the course that should be pursued by a sovereign public where the other party had continued to act in good faith. It is again a case where "might does not make right."

New Ideas and the Established Order.

The theory—and practice—of Mr. Thelen, and those who think with him, would make it seem that there has suddenly arisen a condition which makes it right for the community to say, "we will forget and wipe out all past transactions with reference to our utilities, without any regard to right, equity, or justice, and, on a theory founded on conditions not yet

existing but expected at some time in the future, we will write up a new contract, all the terms of which shall be of our making, and enforceable by us, without regard to the rights, as we see them, of the other parties." A portion of this very unjust idea is due to the love that the author or discoverer or absorber of some new theory has for that theory, and in the case of officials or others newly appointed or elected to carry out certain public matters, an undue amount of zeal is liable to blind them to the justness and equity of their proceedings.

There are one or two further considerations which should be kept in mind by a man in Mr. Thelen's position and before he issues such a final pronunciamento as in this article. He should consider that his article and the statements made in it are absolutely ex parte and without warrant of proper reasoning or correct precedent. He should also consider that to utterly disrupt and disturb such an important class of business as that of the public utilities in the manner he gives intention of doing, is to cause a great deal more evil to both public and utility than the most lax methods of the past. Abrupt changes of this character serve no useful end. Even supposing that Mr. Thelen is right in his conclusions—although they are arrived at incorrectly—it is the part of a wise public policy to make such changes gradually and not to at once locally overturn everything that has been held to be in perfect good faith and correct for a great many years.

Relationship of Utilities to the Public.

There is no question that the facts do not bear out Mr. Thelen in his contention that the utility is simply an agent of the public. If the public owned all the utilities and sublet their operation to private parties, as has been done in quite a number of cases, then, in such cases, those parties would be the "agents" of the public in a greater or less degree, as is arranged under the contract between them. All the facts tend to show that the most that can be claimed for the relations between the public and its utilities is that they are one of partnership, and the extent of the partnership of each as regards the whole is to be determined by the agreements between them, or by collateral local circumstances. My claim is that in a majority of the cases the utilities are not only a partner in the enterprise, but are "preferred" partners in that they originally, and since, have done all the work and taken virtually all the risks. It is an accepted axiom of business "that the risk measures the returns" and all business is carried on and all remuneration begins and continues under that axiom. There is no reason, commercial or otherwise, why this axiom will not apply to a greater or less extent to public utilities, and even if applied to only a small extent it will show that the utility is, in nearly all cases, actually the "preferred" partner. From the time that public utilities were first started up even to the present moment, there has always been a risk in the business, and this risk has always been assumed by the private owners. The share of the public in the business has always been one which entailed no risk whatever on the part of that public as it has always owned and controlled its share in the business and could in no way lose that ownership or control, nor could any action upon the part of the utility financially injure it beyond the immediate power of the public to stop such injury. There is no question as to the fact that, with very few exceptions, the original installation of a public utility was a business risk much greater, as a rule, than that of any other local commercial or manufacturing business, and this risk has not diminished as time has passed; in fact, today, under the theories and attempted practices of Mr. Thelen and those of his school, the risk to the utility is greater than ever before if such theory or practice, or the idea of it in the future, is allowed. As an absolute matter of fact, the risk, the labor, the energy and pains of the bringing of public utilities to the present high standard of operation is entirely due to the private owners and operators of these utilities, and it would be the most weird kind of injustice to suddenly say that these qualities, which bring a proper recompense in private businesses, should not be allowed the same when private individuals apply them to public business.

The question is, as stated previously, one to which business common sense, equity and justice must be applied, and neither mathematics, legal decisions, ex parte opinions of great constructive statesmen, nor untried theories unfitted to present conditions, must be allowed to govern.

Additions to Public Utility Class.

This is especially the case at this present time when the exact definition or state of being of a public utility is absolutely unsettled. Mr. Thelen, and many others of his thinking, are daily desiring to add to the numbers and classes of businesses which shall be made "public utilities." The public easily understands, and certain utilities themselves appreciate the fact, that they are actually what their name is. Those businesses which transact the transportation of people or commodities, such as steam railroads, street and interurban railways, canals, ships, etc.; those which virtually control intercommunication, such as the postoffice, telephone and telegraph companies, and those which furnish, generally, light, heat, power and water, are, by precedent and present purpose, confessedly "public utilities"; but the exponents of the new school of public utility relationship are continually adding to these certain others that cannot, by any possible present definition of a public utility, be classed as such—except arbitrarily.

To put into the class of public utilities such businesses as coal and ice supply, or, as was recently decided in Oklahoma by its public utility commission, to class a newspaper as such, is to make any mercantile or manufacturing business feel that it may wake up tomorrow and find itself by legal, legislative or commission definition, a public utility, subject to the drastic measures proposed by Mr. Thelen. This course, if allowed to any extent, would simply undermine the business stability of every large class of business in the country.

Conclusion

Such a practice is virtually identical with that of the extreme Socialists, whose ideal is that every business operation shall finally be undertaken by the government, and while Mr. Thelen and those of his thinking will probably repudiate the idea that they are ultra-Socialists, the tendency of both their present theory and practice is strongly toward such. There are enough actual and confessed "public utilities" at this present moment, and there are enough problems connected with just these alone to occupy the time and attention of all of us for the next few years in the satisfactory settlement of these problems. Outside of the unwisdom, the absolute recklessness of consequences to both public and utility, consequent upon the injection into the situation of such ideas as those of Mr. Thelen, lies the needlessness of such a procedure. The attitude of Mr. Thelen and those who agree with him in this matter would lead anyone, unacquainted with the subject, to believe that, in the words of the "imperative clause" in some legislative acts "there existed an imperative and immediate public necessity" for the infraction of the ordinary and normal practice of justice, equity and right. While such an "imperative and immediate public necessity" may exist in the minds of a few earnest and impetuous reformers it exists nowhere else.

The country will not "go to the dogs" because the devised "reforms" are not prematurely forced on its utilities, in fact it is less liable to go in a canine direction if we follow David Crockett's maxim "be sure you're right and then go ahead!" In the words of Grover Cleveland: "It is a condition and not a theory that now confronts us" and it is as well to face the condition and its facts and work in conformity with them and give the theories sufficient time to ripen and prove their justice, equity and feasibility.

CO-OPERATION IN PUBLICITY.

BY WM. WOODHEAD.

(This is an outline of the address given by Mr. Woodhead, president of the Associated Advertising Clubs of America, before the San Francisco Jovian Electrical League, March 17, 1914.—The Editors.)

We are living in an advertising age. Everybody advertises in some form or other, or is interested in advertising in some form or other.

That popular philosopher, Abe Martin, says:

"Ev'ry feller that don't advertise haint a fool, but very few fools advertise."

I wonder if you fully realize that within the lifetime of every man in this room advertising was little thought of or used by the better class of business men; was in fact for the most part confined to the promotion of patent medicines, tobacco, liquor, seeds and agricultural implements.

The oldest advertising agency in this country is just forty-five years old next month—and that is a long time measured by present day business standards. Just think for a minute of the tremendous changes that have taken place in our manner of doing business; in our manner of living; in everything that makes up our daily life. Forty-five years ago this country was just binding up its wounds from a giant civil struggle, the like of which the world had not seen before—has not seen since and we hope will never see again.

The first transcontinental railroad had not been finished; cable cars even were unknown, and the trolley car and the telephone idea and all the wonderful things you electrical men are interested in were still locked fast in the brains of their inventors. Business conditions then were as unlike business conditions of to-day as Siberia and California.

Forty-five years ago there were about 5000 publications of all kinds in this country. Today there are over 25,000. The monthly magazine as we know it to-day was unborn, and there were but very few great dailies.

So that, it is only within a comparatively few years that advertising has taken its place as the powerful dynamo of business—the greatest single factor in the up-building of our country, until to-day it is next to impossible to build up a successful business of any kind without its use; and there is not any business, or even profession in spite of so-called "Ethics." that cannot be improved and enlarged by the intelligent use of effective advertising.

The time has passed for giving serious attention to the man who does not believe in advertising. Advertising is as much a part of today's life as the telephone, the trolley car and the automobile.

It is difficult for one not associated with the advertising business to correctly measure the influence of advertising upon the very existence of the average man and woman. What a nation eats and wears—its pleasures, comforts and home conditions—its business—even its politics, are being settled or influenced by this twentieth century economic force, advertising.

Why is it that advertising has become such a powerful factor? Why does it stand on so much higher plane than a few years ago?

Because formerly connected with fraud.

Now-a-days it has taken on new dignity, new strength—publishers and agencies are concentrating efforts for cleaner methods.

American business is facing a better day; the national conscience has been quickened, with the result that sincerity and honesty pay bigger dividends than ever before.

Co-operation is the force that is bringing this about in all our business-life and dealings.

Co-operation, not competition, is the life of trade today.

Co-operation, not co-ercion will bring about Truth in advertising—Honest, believable advertising.

We need more men who are square and thorough in this great work, more men who realize that there is something more than mere enthusiasm, something more to "Truth in Advertising" than shouting "Hooray"; something more than a mere preachment or copy-book head-line; that it stands for a great business principle, not merely because it is right, but because it is the only basis for permanent success; because the only way to make advertising effective is to make it believable.

We are living and working in a wonderful age, an age in which a tremendous evolution, it might almost be called a revolution of business methods and conditions is taking place.

We need men with common sense—men who can successfully combine progressiveness and conservatism.

You men in the electrical world are showing the value of co-operation in your advertising work. Go further and co-operate with us—help us to drive out the faker—help us make advertising more effective and you will be helping yourselves to bigger and more permanent results.

China's telegraph system is government owned and has been operated with considerable success for several years, both in domestic operation and in connection with cables and other foreign lines. There are now 36,339 miles of land and 1000 miles of submarine cable. In 1913 there were in use about 1300 Morse instruments and something less than 50 Wheatstone instruments; there were 561 telegraph stations, an operating staff of 1900 natives and 6 foreigners, and 7522 total employes. The charge for service is 9 cents local currency (4.3 cents gold) per word for messages in a foreign language in the same province; 18 cents local currency or 8.6 cents gold per word for messages to all other places in China and 6 cents local currency or 2.88 cents gold for press messages throughout China. For Chinese messages, which are usually transmitted by sending numbers corresponding to words in a sort of telegraphic dictionary or code book, the charges are two-thirds those for foreign messages, the Chinese press rate being 3 cents local currency or 1.44 cents gold per word. These charges are for all words, including address and signature. The rates, therefore, are high, the equivalent of a 10-word message in the United States, i.e., say 16 words with address and signature in English, costing $1.44 local currency (69 cents gold) within the same province, or 2.88 local currency ($1.38 gold) between various provinces—an average distance something like from New York to Chicago.

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Law

Reference to the authority of the law in its bearing upon public utilities and manufacturing is now made so often, that a consideration of this term should prove of beneficial interest. It should reveal limitations and possibilities, and might incidentally point to a seeming impossibility—the injustice of the law.

This is due to the fact that the law is fluid and adapts itself to its changing container; for the law is what the public would have it, both as regards its enactment and interpretation.

Law is interpreted in accordance with the spirit of the times.

It is a reasoning up to the right—the authority to which the highest law refers.

Precedent merely furnishes a rule or model for subsequent decisions. Alone it has not sufficient authority or justification, but serves as a basis or guide.

Law is intellectual; right-reasoning; the mental advancement of the myriamind in its endeavor to express the principle of perfect rightness.

You will find, if you observe closely, that you are perpetually arguing for and against the thought which would affirm itself to you. It is the reasoning faculty which enables you finally to decide, but to what is the appeal made?

To your highest sense of right at that time, certainly, and is an appeal to the ultimate or proximate good which may result.

Establishing the right, you eliminate the wrong. This is expressed in authoritative repeal.

To-day it is recognized that no action may be considered absolutely right or wholly wrong, merely by reference to existing statutes.

This was illustrated in a recent case before the California Railroad Commission, where the Commission reported "that safety does not require the equipment * * * prescribed in the law," and ordered accordingly.

The letter of the law, too, has become merely a basis. The question must always be, "Is it right?" and the honest reply to that question constitutes the highest law.

Law is in the interpretation, not the text.

How often this is lost sight of by those who say "Lo, here!" or "Lo, there!" only to find their many references susceptible of an entirely different interpretation by the higher courts.

Custom in the law is a canker conducive to travesty.

Early rights and rulings are baneful or beneficial, depending upon their applicability to an enlightened now.

In England at the present, illumination engineers are discussing the best methods of determining the proper measurement of adequate daylight for the illumination of interiors.

Their work follows this bent due to the English doctrine of ancient lights, under which the owner of a building can, through the unobstructed enjoyment of daylight for a period of twenty years, enjoin the owner of immediately adjoining property from obstructing these "ancient" windows. This is the common law

In the United States, however, the law recognizes that windows so placed that they overlook land (of a neighboring owner) which may some day be built upon, are placed and enjoyed merely as a legal right of the owner. He does not in that way minimize, destroy, or take away the equal rights of his neighbor, and the doctrine of ancient lights is therefore here inoperative.

Reasonableness gives force and is necessary to a continuance of the law.

This is but one instance where, on one side the highest sense of right is expressed, while on the other real justice is ignored through reference to custom.

There is no way in which law should be changed save by a reasoning up to the right, and in measures or circumstances which palpably oppress—are unjust—this contention is worthy of consideration, and should so serve to stimulate activities that none will be satisfied with the rights accorded until the highest conception of right has been expressed.

It should be noted in passing that this will almost invariably call for the recognition of the validity of agreements until they expire, if made in accordance with the highest interpretation of the law at the time they were executed.

Waste and the Fire Hazard

Waste is want, or worse. The electrical fire hazard is more or less a myth. It is so, however, due to the early handling of the problem intelligently, and in a broadly educative manner, and to present vigilance. The trade, as well as the public in general, learned that if you would tame the "lightning," it could be accomplished only by realizing that, like fire, it would prove a good servant only if controlled. The mastery must remain with man.

The result is, that electrical fires are mostly "so-called," and that even the greatest number so attributed is but a small percentage of the whole. It is variously stated at from five to fifteen per cent, and although this seems trifling, it looms large when it is considered that the annual fire loss of the United States is estimated at over one billion dollars, and that the losses due to fires from electrical causes is from fifty to one hundred and fifty million dollars.

This loss if really electrical is largely preventable.

Extravagance in whatever form must be eliminated from the national life, for true conservation and economy, which are now so essential, result only from efficiency.

The work of the National Board of Fire Underwriters is therefore economic and in this way a national advantage. As an incident to the efforts of the Board, standards of work are improved, and satisfactory results assured. This means increased business and contented customers.

The presentation of this subject by Mr. F. D. Weber, which commences in this number, is of general interest, though referring particularly to the State of Oregon. Studied, it will serve as an incentive to all to encourage the establishment of the principle expressed in the Underwriters' electrical slogan, "Let the Code Decide."

In connection with this series the readers' attention is directed to the facilities offered by this journal as a forum for the discussion and elucidation of matters pertaining to the National Electrical Code. The readers' attention is particularly directed to page 326 of this issue, to the department there conducted by the California Association of Electrical Inspectors, Section of N. A. E. I.

The success of this department, from the support given, is assured, but its success and its value to you will be greater if you take advantage of the facilities there offered for the interpretation of your "Code" problems.

A New Business Basis

Business is that which busies one; an exchange of good offices; the need is recognized and accepted, that profit shall result from business. Where it is desired that the business relationship shall be continuous the basis of business must be confidence. No man has confidence in his enemies. It is therefore safe to assume that you do business with your friends. Business is based upon friendship.

There is nothing new in this new business basis except the advantages which accrue from action in accordance with its recogntion.

Not to be misunderstood, it should be stated that friendship alone is not enough. Continued confidence demands that you "deliver the goods."

There is a popular notion that business is predicated upon selfishness. Though the surface appearance favors such a conclusion, nothing is more wide the mark.

An awareness sufficient to counteract selfishness would cause business to be conducted upon a policy of distrust.

Distrust is dissolution.

To say things which are not true or only nearly so, an outgrowth of selfishness, is to disregard the rights of others. The "others" are not so foolish that this will not be detected.

Caring only for one's own interests, to the exclusion of those of others, is to court isolation, for but infinitesimal business could be transacted by a castaway on the Island of Selfishness with its population of one.

The exchange of good offices constitutes service. Those we love most we serve best. Bigger business and better will result from recognition of the principle that you are, and must of necessity be doing business with your friends.

Selfishness is the harrowing destroyer of business, friendship the founder.

Personal consideration, which is something different, is essential to self-preservation, but selfishness limits patronage until it shrinks again into self.

Cultivate the point of view of your friends.

Regard for the rights of others is not self-sacrifice, but is quite compatible with business building principles.

Yours is not a malicious purpose. There is nothing to hide. You would serve.

This service will make friends and these will improve your business. Remember that your enemies can neither be persuaded or coerced into doing business with you.

Then respect those with whom you do business, and take a growing interest in their welfare. In this way you make friends and express friendship—the new basis of an assured business success.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

Geo. Wolf, electrical contractor, Oroville, Cal., spent several days of last week at San Francisco.

P. B. Hyde of the Edison Storage Battery Company, has returned to San Francisco from the East.

G. Douglas Jones, state electrical engineer, was at San Francisco last week from Sacramento, Cal.

Chas. Baker, district engineer, Westinghouse Machine Company, is at present in Southern California.

George C. Cooke of the American Cross Arm Company, was at Seattle on business during the past week.

H. C. Currier, electrical engineer, Yosemite National Park, was a visitor at San Francisco during the past week.

J. E. Jansen of the Jansen Electric Company, contractors, Eureka, Cal., made a business trip to San Francisco recently.

E. J. Edwards of Scanlan & Edwards, electrical contractors, Walnut Creek, Cal., was a recent visitor at San Francisco.

J. M. Smith, assistant to salesmanager, Holophane Works of General Electric Company, is at Los Angeles from Cleveland, Ohio.

K. B. Miller of Chicago, Ill., managing director of the Bend, Oregon, Water, Light & Power Company, was at Bend recently.

N. C. Wolf, purchasing agent, Mt. Whitney Power & Electric Company, Visalia, Cal., was at San Francisco recently on business.

Charles E. Wells, who purchased control of the Hillsboro, Oregon, Telephone Company, has assumed management of the company.

J. S. Dennis of Calgary, B. C., assistant to the president of the Canadian Pacific Railway, was at San Francisco during the past week.

Geo. A. Boomer, Pacific Coast representative, Plume & Atwood Manufacturing Company, has returned to San Francisco from the Pacific Northwest.

Fred O. Dolson, who has recently returned from South America, has joined the engineering staff of the Pelton Water Wheel Company, at San Francisco.

George Hughes, president Hughes Electric Heating Company, who has been making a trip through Oregon and Washington, has arrived at San Francisco.

John M. Morris, with the Westinghouse Electric & Manufacturing Company at Los Angeles, Cal., has left on a visit to the company's works at East Pittsburg, Pa.

A. W. Beachler is president, **John Meyer**, vice-president, and **Chas. P. Whalen**, secretary and treasurer of the Home Telephone Company, recently organized at Genesee, Idaho.

Frank Wing, until recently a member of the operating staff of the Oregon Power Company at The Dalles, has been transferred to Eugene, Oregon, as general purchasing agent.

H. F. Holland, Western representative of the Simplex Electric Heating Company, has returned to Salt Lake City, after a month spent in California looking over the field there.

A. M. Hamlett, electro-chemical engineer with the V. Whiting Company, Boston, Mass., is at Oakland, making an installation of electrolytic cells for the Electro-Alkaline Company, Oakland, Cal.

G. B. Harrington, assistant to the manager and superintendent of lines, Puget Sound Traction, Light & Power Company, Seattle, is visiting Chicago and other Eastern cities on company business.

Arlington Bensel, sales manager, Driver-Harris Wire Company, Harrison, N. J., visited Los Angeles and San Francisco during the past week and intends visiting other Pacific Coast and northwest cities on business for his company.

C. A. Norton, with the Westinghouse Electric & Manufacturing Company at Spokane, Washington, has been appointed Jovian Statesman for the North Yakima Valley, and plans to hold a rejuvenation at North Yakima, Wash., at an early date.

James Allen, chief engineer Washington State Highway Commission, has been appointed by Governor Lister as the state's representative on the joint commission of Washington and Oregon on the investigation of the power possibilities of the Celilo falls.

A. G. Mackenzie of Salt Lake City, who for five years held a position with the Mountain States Telephone & Telegraph Company in its public relations department, was appointed secretary of the Utah-California Expositions Commission, at its last meeting. Prior to entering the electrical field, Mr. Mackenzie was engaged in newspaper work for several years. He left the telephone company to become assistant secretary and publicity director of the Salt Lake Commercial Club, where he remained a year, at the end of which time he established a publicity and advertising agency which he now conducts. Mr. Mackenzie is a member of the Utah Electric Club and the Jovian Order, and takes an active interest in all things electrical.

W. F. Minor has been appointed manager of the Holophane Works of General Electric Company, Cleveland, Ohio, to succeed Mr. V. R. Lansingh. Mr. Minor has been connected with the Holophane Works during practically all of his business career, and is known throughout the country as a type of progressive young business man and as a remarkably successful sales manager, from which position he has now been promoted. He is admired by all those who have had the pleasure and privilege of working with him and his many friends will learn with pleasure of his due advancement. As newly appointed manager, Mr. Minor has made the following statement of Holophane policy:



"I believe that no organization is truly successful unless it creates a product which is honestly useful, which makes people's lives easier to live and happier. And next to usefulness, I believe that the success of an organization depends upon promptness, accuracy, and square action in the daily details of its business. The aim of the Holophane Works is to produce reflectors that are a real solution to lighting problems, artistic or commercial, and at the same time to carry on every day's business in the straightforward way that squares with an honest purpose. I believe that if we hold to this policy we shall deserve and obtain the solid support of the consumer and of the dealers who serve him."

OBITUARY.

V. C. Connolly, local representative of the American Steel & Wire Company at Salt Lake City, died suddenly at Idaho Falls, March 27th. Mr. Connolly was taken ill there, but did not anticipate the serious nature of the illness, and wired friends at Salt Lake City that he expected to be here in a day or two. Mr. Connolly was well known throughout Utah, Idaho, Montana, Arizona and Nevada, where he has made many business trips in the interests of his company. He was a member of the Utah Electric Club and of the Jovian Order.

MEETING NOTICES.

Seattle Engineers' Club.

The Seattle Engineers' Club met Thursday, April 2nd, at luncheon at the College Club. Mr. William de L. Benedict, mining engineer and member of the New York Engineers' Club, gave a brief talk on engineering activities.

San Francisco Electrical Development and Jovian League.

The league met at the Hof Brau, now the regular meeting place, last Tuesday. W. F. Neiman presided. The entire time was devoted to routine business, matters of importance to the league being fully discussed and decided upon.

Utah Electric Club.

The regular weekly luncheon was held at the Commercial Club, Thursday, April 2nd. C. C. Pratt, of the Mountain States Telephone and Telegraph Company, presided. The chairman appointed H. F. Holland, C. B. Hawley and G. H. Williams a committee to draft resolutions of sympathy on the death of V. F. Connolly, a charter member of the club, who died unexpectedly at Idaho Falls last week.

Miss Helen L. Bartlett, teacher of cooking at the Salt Lake High School, read a paper entitled, "Electricity and Its Application to Efficiency Methods in the Home." Miss Bartlett has made a careful study of this subject, and presented in a clear, concise manner the many ways in which the thoughtful housewife may save time, effort and money by the application of electricity to the various household operations.

Seattle Jovian League.

The Seattle Jovians held their weekly meeting at the Washington Annex at 7 p. m., Friday, April 3rd, with about twenty-five members present. J. R. King of the Puget Sound Light & Power Company gave an interesting talk on the question of electric heating and cooking for residences. Charts showing the average load curves were exhibited and it was pointed out by Mr. King that considerable study had been given to the possibilities of establishing an extra low rate for this class of consumer with the result that no lower rate seems feasible at this time than the regular power rate inasmuch as certain tests made in several residences show that cooking and heating in the average home does not tend to raise the off peak load any more than the peak load which occurs between the hours of five and ten p. m.

Burton R. Stare described the electric heating system in his residence, which was interesting and instructive.

The Jovian Electrical League of Southern California.

There is no more vital subject before the electrical fraternity of the southland in general and Los Angeles in particular, than the coming bond election by the people to determine whether or not the city shall build its own power plants and a distributing system. It was not surprising, therefore to find an attendance of 125 at a recent luncheon at Christopher's, Los Angeles, to listen to the presentation of the city's arguments in favor of the bond issue by L. F. Scattergood, chief electrical engineer Aqueduct Power Commission, who spoke on "The City Power and the Proposed Issue of Bonds." Mr. Scattergood took decided issue with the statements of General Manager Ballard of the Edison Company, made at the luncheon the week previous and the Jovians were thus treated to an able debate on the situation.

Mr. Scattergood said that much fear is expressed that the city will not treat the corporations fairly and that some of the companies' investments may suffer as a result. People do not stop to consider that the people of Los Angeles have invested in the aqueduct and power projects $30,000,000, which must be protected and made to pay, and that this sum involved, all of it the people's money. He also brought out the point that private corporation, planning to enter the field in Los Angeles, would have gone into the fight neither asking nor giving quarter and would have made the companies now here an expensive and bitter fight. The city on the other hand offers to buy the companies' plants for distribution at a fair figure and let them retire from the field with their money back and all their past years' profits as a bonus. The speaker urged the importance of having the money in the bank before starting a big business transaction and said that Los Angeles would then be in a position to deal with the companies on a more definite basis, not now afforded. Among the guests was A. Hensel, sales manager of the Driver-Harris Company, a past Jovian Statesman of New Jersey, who addressed a few complimentary remarks to the Southern California contingent. The luncheon was presided over by John M. Morris.

NEVADA INDUSTRIAL SAFETY ASSOCIATION.

As a result of the recent meeting on industrial safety at the University of Nevada, the committee appointed by Governor Oddie has drawn up a constitution and by-laws and the first annual meeting will be held at the University of Nevada on April 18th. Prof. J. G. Scrugham, who was instrumental in starting this movement, is acting secretary. The plans provide for an executive committee of nine members, the president, six vice-presidents, secretary and director of exhibits. Each vice-president is to be chairman for one of the following committees: Mining, electricity, transportation, agriculture, varied industries and publicity.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The commission has rendered a decision authorizing the San Diego Consolidated Gas & Electric Company to issue 5 per cent bonds in the sum of $23,000. The bonds are to be sold at 85 per cent of their face value. The proceeds of the bonds are to be applied to discharging and refunding indebtedness incurred for capital expenditure during the month of February, 1914. These bonds are a part of an issue of $459,000 which the commission had previously authorized under certain restrictions.

The commission has rendered a decision granting authority to the Marin County Electric Railways to construct a street railway line in Mill Valley, Marin county, and to sell $67,000 in stock for its construction. The order, however, is surrounded by several conditions. The commission finds that the nature of the enterprise is such that the stock should be sold only to residents or property owners in Mill Valley. In this connection the commission says that while it would not authorize the sale of a stock of this kind broadcast, it would be slow to deny any community the right to sponsor such an enterprise if it desired to do so with full knowledge of the financial responsibilities involved. The commission expresses the opinion that the benefits to be derived will accrue rather through possible increase in property values and in general convenience than through any returns that might be expected on the stock.

The commission has rendered a decision in which it fixes the value of the Eureka Water Company, for condemnation proceedings, at $270,000. This is the first decision of the commission under the amendment to the public utilities act empowering it to fix on application of towns, cities, counties or municipal water districts, the value of public utility properties sought to be acquired by the public. The city of Eureka, Humboldt county, filed an application November 24, 1913, in which it asked the commission to proceed under the amendment to the act, and the initial hearing was held at Eureka, March 5, 1914.

PLAY BA-A-ALL.

The big game, Peddlers v. Pawnbrokers, advertised to be played at San Francisco on the Ocean Shore Grounds, Twelfth and Mission streets, last Saturday, was postponed on account of rain. Game will be called at 2:30 p. m. sharp on Saturday, April 11th. You had better be there.

CALIFORNIA ASSOCIATION OF ELECTRICAL INSPECTORS

Section of N. A. E. I.

C. W. Mitchell, President. Arthur Kempston.
Wm. G. Pennycook, Vice-Pres. B. C. Hill, Executive Comm.
John W. Carrell Secretary-Treasurer, 55 Fulton, San Francisco

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correllate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

By the Secretary.

In the natural order of things a place is not provided for a state of greater than perfection. A line cannot be stretched so as to be above plumb. Perfection is a highly improbable state.

Rules governing electrical construction which cover every particular case do not exist and the author of such is yet unborn. Cases arise, occasionally, which require departure from the standard and in which, special methods of construction must be used, but such cases are the exception and not the rule. The National Electrical Code comprises a very practical set of rules, is the best and most complete ever published and covers every case that could be anticipated. For this reason permission to use special methods of construction should be granted only in cases where standard construction would be installed at an extreme disadvantage and where the purposes of the code will be maintained. All electricians, whether contractors, journeymen of other, who are interested in securing a better and more uniform standard of construction and in promoting uniform interpretation and enforcement of the rules which comprise the standard should send us questions on construction met with in practice.

Questions and Answers.

Ques. 1. Three cabinets enclose cut-outs for motor circuits; form part of a conduit system; are installed in the shaft of a freight elevator in a large reinforced concrete building occupied as a factory; are located at different floors, and are within easy reach from the elevator platform. Each cabinet is made of No. 16 U. S. gauge metal treated to prevent oxidation; does not exceed 360 sq. in. in area nor 24 in. in any single dimension; is provided with a cover which has turned flanges and which is secured in place by means of four machine screws. The work was installed in a completed building. Is this a code job? If not, why not?

Ans. 1. No. Fuse cabinets must not be installed in an elevator shaft.

Ans. 2. The code does not specify that there shall be doors but section 70 (g) specifies how a door shall be constructed, that the fact the cover above is fastened with four machine screws makes one more fastening than if it were a door, the cover can become lost or set aside and I would be inclined to hold that all cabinets should be hung on hinges, nevertheless I believe the above installation is code work and the fire risk is not increased.

Ans. 3. No. See 23 (c) and 70 (g).

Ans. 4. No. Not readily accessible as must depend on elevator and should have door instead of cover.

Ans. 5. If this means door frame is bolted on and door is hinged and catched I should say there is no rule not to accept it.

Ans. 6. No! Rule 23 (c) "Must be readily accessible." Would not consider an elevator shaft readily accessible, particularly if the car could not be operated and the elevator doors were locked from the inside as they are supposed to be.

Ans. 7. No. Rule 23 (c) states that cut-outs must be readily accessible. I would not consider this installation as complying with this requirement. Covers should not be fastened by means of screws but should have hinges and a catch or lock.

Ans. 8. If this means door frame is bolted on and door is properly hinged and catched would say there is no rule not to accept the same. I do not consider installing cabinets in elevator shafts as good practice if possible to locate them elsewhere because of the following conditions. Fire occurring in any of the cabinets might be quickly communicated to adjacent material because of the extra heavy drafts prevalent in shafts and because the cabinets would be completely inaccessible if the elevator goes out of service. I would not consider cabinets accessible at all times if there was any chance of elevator going out of service through being on the same service as the cabinets, trouble occurring in the first cabinet, or, if on a different service, on trouble occurring in its own service leads, or on trouble such as hoist cables coming off sheaves.

Ans. 9. Not a code job. Cabinet exposed to mechanical injury from freight extending over edge of elevator. Should have hinges on door.

Ques. 2. Does the code permit the main service switch for a building to be located on the outside thereof?

Ans. 1. Yes. The rule for service cut-outs provides that they shall be inside the walls; the rule for service switches has no such provision. Furthermore, the rule for cut-outs provides for the location of such cut-outs where the service switch is inside the building.

Ans. 2. Yes! Rule 23 (a), "Where the switch required by 24 (a) is inside the building," would, it appears to me, indicate that it could be placed on the outside, and 24 (a) does not designate either the inside or outside of a building, providing it complies with Rule 24 (b).

Ans. 3. Yes, but not service fuses.

Ans. 4. Yes, when installed in a watertight metal service switch box with the lettering "Main Service Switch" on the door of box.

Ans. 5. Yes, if not exposed to weather.

Ans. 6. Yes, if on building.

Ans. 7. No, not unless the switch is protected from the weather.

Ans. 8. Yes, if enclosed in metal watertight box with "Service Switch" marked on face of same.

Ans. 9. The code does not say whether the service switch shall be located inside or outside, but does say that it must be located in the nearest accessible place to where the wires enter the building. See Sec. 24 (a).

Ques. 3. Does the code permit two services both carrying d.c., but each from a different company, to be enclosed in the same conduit?

Ans. 1. I should say that these are different (systems) on account of variation in voltage and according to N. E. Code. Rules say No.

Ans. 2. No.

Ans. 3. If both systems are within the same potential limits as given in the code there is no rule which prohibits such an installation.

Ans. 4. No. See Code 26 (p).

Ans. 5. No. Different systems.

Ans. 6. There is no rule in the code prohibiting two services of any kind in one conduit unless you can stretch Rule 26 (p) which says, "and must never contain circuits of different systems," and call the services circuits.

Ans. 7. I would consider two d.c. services each from a different service company as two different services and would say no. (Rule 26 (p).)

Ans. 8. No.

Ans. 9. Section 26 (p) last paragraph provides that circuits of different systems must not be run in the same conduit.

NEWS NOTES

FINANCIAL.

SAN FRANCISCO, CAL.—The United Railroads of San Francisco has reported for the year ended December 31, 1913, showing the following changes: Gross earnings increased $80,179; net after taxes decreased, $203,938; total income decreased, $318,648; surplus after charges decreased, $284,065; reserve decreased $107,353; final surplus decreased $176,712. The detailed report follows:

	1912.	1913.
Gross earnings	$8,471,675.96	$8,552,854.72
Operation and taxes	4,878,582.22	5,163,696.43
Net earnings	3,593,093.74	3,389,158.29
Other income	285,322 10	170,609.94
Total income	3,878 415.84	3,559,768.23
Income charges	264,522 57	373,274.30
Net income	3,613,893.27	3,186,493.93
Bond interest	1,806,576.65	1,663,243.33
Surplus	1,807,316.62	1,523,250.60
Renewals and depreciation	183,607.69	257,581.46
Sinking funds	655,757.84	474,431.89
First preferred div.	350,000.00	350,000.00
Net surplus	617,949.09	441,237.25

The decrease in net earnings is said to be due to the competition of the Geary street municipal line and to the general depression.

INCORPORATIONS.

ASTORIA, ORE.—Articles of incorporation of the Ewart Electric Company have been filed by Dale S. Ewart, Chas. Standland, et al. The capital stock is $5000.

SAN FRANCISCO, CAL.—Fresno Interurban Railway Company, $250,000, shares $100 each, subscribed $10,000, by G. H. Brandner, 98 shares; J. B. Rogers and P. F. Fratessa, one share each.

EL CENTRO, CAL.—Articles of incorporation for the El Centro, Imperial & Calexico Electric Railway Company, with capital stock of $200,000, have been filed at San Diego. Lewis R. Kirkland, formerly district attorney of San Diego county, is named as one of the promoters, while eastern capital is said to be interested. It is contemplated to build a line 20 miles long.

FRESNO, CAL.—Articles of incorporation of the San Joaquin Valley Telephone Company, have been filed. The company will build a telephone line from Graham to Jameson, on the west side of what was formerly the J. G. James ranch. The company is capitalized for $10,000, and the directors are Frank H. Edwards, James M. O'Brien and Luther P. Spalding of Los Angeles.

SPOKANE, WASH.—H. M. Boomer, senior partner of Boomer & Hughes, railroad contractor, C. L. Mackenzie of Colfax, Edward Rigg and other Spokane and Inland Empire business men, have formed a $400,000 corporation to develop water power. The name of the concern is the Salmon River Power & Light Company. The company proposes to develop power in Idaho near Shannon.

ILLUMINATION.

BUCKLEY, WASH.—The Buckley Electric Company has been granted the right to construct an electric system over alleys and streets in this city.

OREGON CITY, ORE.—The transfer for placing gas mains and furnishing gas service in this city, from A. L. Beatie to whom it was originally granted, to the Portland Gas & Coke Company, has been effected.

EVERETT, WASH.—A franchise has been granted to the Sultan Electric Company for the right to construct a power line to convey electric energy for lighting, power and heating purposes along roads and streets in Snohomish county.

REPUBLIC, WASH.—By the purchase of the $20,000 stock of the Republic Light & Power Company, Z. E. Morrill and A. L. Capers have taken over the properties of that company. Messrs. Merrill & Capers will install a new engine.

GREEN RIVER, UTAH.—The town board has petitioned the state land board for permission to construct an electric power plant to furnish the town with electric light and power. The board will consider this application at its next meeting.

LOS ANGELES, CAL.—The city council has adopted a resolution instructing the board of public works to advertise for bids for furnishing electricity for street lighting for 18 months. The resolution provides for the installation of 500 additional street lights in various parts of the city.

LEHI, UTAH.—C. W. Earl and associates have made application to the city council for a franchise to install and operate an electric light plant for this city. Their proposition was referred to Councilmen Evans and Gilchrist, who will make a report at the next session of the council.

TRANSMISSION.

LOS ANGELES, CAL.—The power bond election will be held May 8th, instead of May 5th, according to the city council, the reason for the change being that the county has fixed a special election for the 5th.

OXNARD, CAL.—The Pacific Light & Power Company is getting material together preparatory to starting work near Santa Susana, for the extension of its lines into the eastern part of the county. G. B. McClain is engineer in charge of the work.

FILLMORE, UTAH.—Messrs. Yates and Richards of Salt Lake City, Utah, have filed on a water power site in the canyon near Fillmore, Utah. They have submitted a proposal to the city council relative to installing an electric lighting plant for the city, the cost of which is estimated at approximately $17,500.

TUCSON, ARIZ.—Contracts between the city, the Tucson Gas, Electric Light & Power Company, and the Tucson Rapid Transit Company, have been approved by the city council, and as a result, $200,000 will be spent at once for improvements, including new electric railway line on Myer street, power plant, new cars, new power lines, etc.

OXNARD, CAL.—Control of the Ventura County Power Company has been purchased by H. E. Huntington. The company is capitalized for $2,500,000, but the amount involved in the transaction is not announced. Mr. Huntington has purchased the plant and system in order to provide a wider territory for the distribution of the power of the Big Creek plant.

PRESCOTT, ARIZ.—The Pacific Water Company, E. H. Meek, president, announces that engineers will leave at once to make first surveys, after which construction on a power project on Verde River will be taken up. Two power plants are to be built on the river below the point where Fossil Creek empties into Verde, while one plant is to be located in the canyon about 12 miles below Camp Verde. The field to be supplied with electrical power is Miami and Globe.

LOS ANGELES, CAL.—Approximately $3,750,000 is to be spent this year by the Southern California Edison Company for additions and betterments to care for rapidly increasing business, according to an announcement by Secretary and Assistant General Manager Ballard of that company. Other concerns announcing proposed expenditures for similar pur-

poses are the Santa Monica Water Company, which will expend $96,073, and the Glendale and Eagle Rock Railway Company, which has outlined improvements which will cost $57,292.

TRANSPORTATION.

SANTA BARBARA, CAL.—W. A. Brackenridge, president of the Santa Barbara & Suburban Railway Company, has announced that the company is considering building a suburban line from Santa Barbara to Carpinteria.

PRESCOTT, ARIZ.—The building of a new electric railroad from Crown King to the camp of the Nelson Mining Company will begin in April, according to Geo. P. Harrington, general manager. The road will be standard gauge.

GLENDALE, CAL.—Paul Shoup, president of the Pacific Electric Railway Company, has informed residents of the east side of Glendale that the company's line to Glendale will be extended at once over Broadway to the corner of Everett street.

PORTLAND, ORE.—A new and extensive system of interurban electric car lines is proposed by S. Carver, promoter of the Portland & Oregon City Railway. If carried out this will connect Portland with several well settled districts, including Damascus via Happy Valley and Stone and Logan, via Harmony, Clackamas and Clear Lake.

SAN FRANCISCO, CAL.—The protests of property owners in the proposed Church street railway assessment district are to be taken up for consideration at a special meeting of the board of supervisors April 14th. The protestants object to being called on to pay for the new street, which is said to be necessary in order that the municipal railway may be built on Church street in accordance with the city engineer's plans.

SAN JOSE, CAL.—Capitalists who have taken over the interests of the San Jose Terminal Railroad Company are to have an opportunity to build the line, which they hope to have in operation by the opening of the Panama-Pacific Exposition, taking passengers from this city direct to the exposition gates. At a meeting of the mayor and common council a San Francisco capitalist withdrew his objections to the line passing through a new subdivision about to be opened in the northern outskirts of the city and an extension of old franchises granted the company, but made void by failure to complete construction, was granted. The extension holds good until January 1, 1915, and the officers of the company, represented by Lee H. Landis of the Tidewater & Southern Railroad, have promised to complete construction on schedule time.

SEATTLE, WASH.—A resolution was introduced authorizing and directing the board of public works to immediately prepare plans and specifications for Division B of the municipal street car system. Construction is proposed from the proceeds of the sale of $500,000 of the $800,000 street railway bonds authorized three years ago, but these securities will not be offered until after the supreme court has passed upon the suit instituted in the superior court seeking to restrain the city from selling $425,000 of bonds authorized for an auxiliary steam power plant, on the grounds that the city is already bonded to its limit of indebtedness for such purposes. This suit is brought to determine whether bonds for light and power development should be a charge against the allowance for water, light and sewers, or against the allowance for general fund purposes. State statutes give the city authority to issue bonds for light purposes, but is silent on power purposes, and the question has been raised by New York attorneys, who hold that in the absence of expressed authority to issue bonds for power purposes the $3,240,000 of bonds already issued for light and power purposes should be a charge against the general fund allowance. In the event the supreme court should hold that light and power bonds are a charge against the general fund allotment, amounting to 5 per cent of the assessed valuation, Seattle would stand in the position of being overbonded for general purposes.

TELEPHONE AND TELEGRAPH.

SAN FRANCISCO, CAL.—Approximately 70 miles of automatic fire alarm wiring will be installed in the main exhibit palaces of the Exposition. The contract for this work has been awarded to the Aero Fire Alarm Company.

NOGALES, ARIZ.—According to H. D. McVay, special agent for the Mountain States Telephone & Telegraph Company, Nogales will shortly have a complete new telephone system, the company to start erection of the new plant about May 20th.

SANTA BARBARA, CAL.—Frank J. Richards, recently appointed manager of the Pacific Telephone Company in this city, states that the company has just allowed him $2000 for extensions and other improvements in this city, on which work will begin at once.

LOS ANGELES, CAL.—Beginning May 1st, the Marconi Wireless Telegraph Company will open a through wireless service to Honolulu and by next fall, it is announced, wireless communication will be opened with Yokohama, Japan, via San Francisco, Honolulu and the Philippines. This will enable the wireless company to cut under the cablegram rates at least 20 cents a word. The cable rate from San Francisco to Honolulu is 35 cents a word. The wireless rate will be 15. Messages filed through the Los Angeles Marconi office at the harbor will be relayed to San Francisco and then sent through to Honolulu. It is announced, every Western Union office in the country will then accept wireless messages for Honolulu.

OLYMPIA, WASH.—The filing of a set of telephone rates by the Postal Telegraph Company with the public service commission apparently announced a unique departure in the telephone business in the state of Washington and to Portland between that city and Washington points, and the extreme cut in the rates, when compared with the rates of the telephone companies doing business in Washington, is almost sensational. It is the plan of the Postal company to install telephones over the telegraph wires. Under the new system, the Postal company proposes such rates that a message of ten minutes' duration, from Seattle to Spokane for example, which over the wires of the present companies would cost $6.65, will cost only $1.50, and rates between other cities are proportionate. Whereas now between Seattle and Tacoma it costs $1.10 to talk ten minute, under the Postal's regulations it would cost only 50 cents. Other reductions proposed are proportional. Lack of a terminal distribution system on the part of the Postal company is a feature that adds interest to the possibilities of the new venture.

WATERWORKS.

MONTAGUE, CAL.—The city trustees have sold the entire issue of $25,000 of municipal water bonds to V. E. Warrens of Hilt, Cal., on his bid of par, accrued interest and $601 premium.

MILTON, ORE.—At a special election the people of Milton carried a proposal to issue $18,000 worth of bonds for the extension of the city water supply, and for the improvement of the city power plant.

KAMIAH, IDAHO.—The city has purchased the present water system here for $11,500. The city has been bonded for $13,500 to cover the purchase price and erect a concrete reservoir, upon which work will begin in a few days.

PASCO, WASH.—Mayor A. M. Johnson has affixed his signature to the issue of $50,000 worth of bonds to the Pasco Reclamation Company in payment of a 500 acre water right. The bonds will be in denomination of $500 and run 10 years.

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BY JOHN B. FISKEN.

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METERING DIRECT CURRENT POWER WITH CURRENT TRANSFORMERS.
BY OTTO A. KNOPP.

THE FERRIS WATER POWER BILL.

SPECIFICATIONS FOR WESTERN RED CEDAR POLES.

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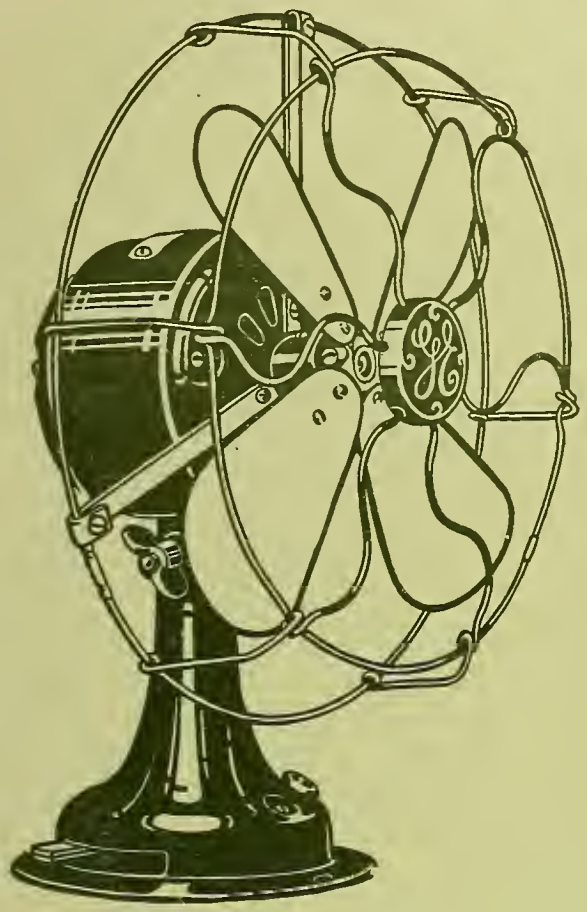
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JOURNAL OF ELECTRICITY

POWER AND GAS

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VOLUME XXXII SAN FRANCISCO, APRIL 18, 1914 NUMBER 16

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LITTLE FALLS TIE LINE

BY JOHN B. FISKEN.

(This article constitutes a valuable contribution on the subject of transmission line construction. The particular line is carefully described, reasons being stated for the choice of materials and methods employed. Details of the construction work are also given. The paper was presented in full by Mr. Fisken at the Engineers' Convention held at Moscow, Idaho, January, 1914.—The Editors.)



View of Little Falls Power Station, Washington Water Power Company.

It is not the intention of the author to submit an academic treatise on the theories and formulae involved in designing transmission lines, but to offer in a simple manner a description of the Washington Water Power Company's Little Falls Tie Line, the only steel tower transmission line in the Inland Empire.

What is known as a "Tie Line" is a line connecting two or more power plants or substations in contra distinction to a "Distribution Line" which distributes power to the consumers. A transmission line properly speaking is any line which transmits electric power, but common usage has limited the use of the term to high tension lines, a limitation which, in the author's opinion, is wrong.

Reason for Building the Line.

Little Falls is situated on the Spokane River about 45 miles below Spokane, and in 1910 the company put in commission a power plant erected at that point. This plant has a capacity of 20,500 kw. and except for that which is used in the Big Bend country all of this power has to be transmitted to the Twenty-ninth avenue substation at Spokane, where part of it is transformed for use in Spokane, while the balance is distributed in conjunction with the power generated at Post Falls over the various 60,000 volt distribution lines.

The Circuits.

There are two circuits each having a transmission capacity of 12,500 kw. with power losses and regulation as follows:

Line Drop and Losses.

Power Factor, per cent.	Power Loss, per cent. 12,500 kw.	25,000 kw.	Line Regulation Drop, per cent. 12,500 kw. Leading.	12,500 kw. Lagging.	25,000 kw. Leading.	25,000 kw. Lagging.
100	3.05	7.1	3.2	...	7.1	....
95	....	...	1.	5.5	2.7	11.4
90	3.75	7.5	zero	6.5	0.6	13.4
80	4.7	9.4	...	8.4	...	....

The above figures may be and no doubt are off a small fraction of one per cent as they were scaled from a diagram and not calculated.

The loss at 25,000 kw. might appear somewhat excessive but one circuit is only intended to carry that load in case the other should for any reason be out of service.

The Voltage.

A transmision voltage of 60,000 volts was decided upon, as the company has an extensive system of distribution lines operated at that voltage and it was consid-

ered very desirable to connect the Tie Lines with the distribution lines without interposing any transformation. While the amount of power transmitted is large the distance is short and a voltage of 60,000 permit-



View of Twenty-Ninth Ave. Substation Showing Incoming and Outgoing 60,000 Volt Lines and Outgoing 13,200 Volt Lines.

ted the transmission of the power over conductors of reasonable size with reasonable loss.

The Conductors.

The question of copper or aluminum, to be used for conductors was given full consideration, the decision being in favor of the latter. One of the objections urged against aluminum was that the metal being soft the conductors would have to be handled very carefully as they would be liable to be seriously damaged if they should be pulled over rough rocks. To prove or disprove this claim a length of about 1000 ft. of cable of approximately the size which would have to be used was secured. On the right of way of the Medical Lake Railway a place was found where numerous jagged rocks and rough boulders stood above the surface of the ground; a team of horses hitched to one end of the cable pulled it back and forth twice over this ground without any attempt being made to protect it from the rocks. An examination of the cable, after it had finished its journey, showed practically no damage; the outer surface was scratched, but no cuts or dents liable to weaken it could be found. A comparison of the two metals is shown in the following table:

Comparison of Available Conductors.

	Aluminum.	Hard Drawn Copper.
Specific gravity	2.68	8.93
Relative specific gravity	1.00	3.33
Conductivity (Mattheissen Standard Scale)	61 to 63	96 to 99
Tensile strength per sq. in.	26,000 to 30,000	55,000 to 65,000
Elastic limit, about	14,000	30,000 to 35,000

If we assume a conductivity of 97 for copper and 62 for aluminum we get a ratio of 1:1.565 or in other words a copper wire of 100,000 c.m. is equal in conductivity to an aluminum wire of 156,500 c.m.

As shown in the table the relative weights of aluminum and copper for the same section are 1 and 3.33 and for the same conductivity we get $\frac{1.565 \times 1}{1 \times 3.33} = .47$.

Or in other words the weight of an aluminum conductor per 1000 ft. is 47 per cent of the weight of a copper conductor per 1000 ft. having the same conductivity. Inasmuch as it is necessary to use a larger cross section of aluminum in order to obtain equal conductivity with copper, it is also necessary to take this increased size into consideration in determining the relative breaking loads.

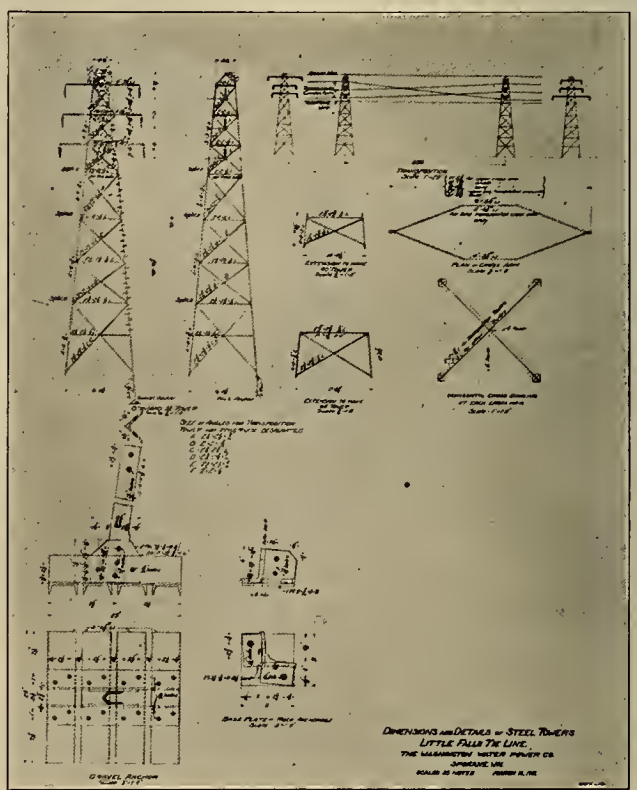
Assuming a unit strength for aluminum of 24,000 lb. (the strength provided for in the specifications for the conductors used in this line) and for copper 60,000 lb. the relation of the two conductors becomes

$\frac{1.565 \times 24{,}000}{1 \times 60{,}000} = \frac{37560}{60000} = .62$, i.e. an aluminum conductor has only 62 per cent of the strength of a copper conductor of the same carrying capacity. Fortunately the load which the conductors on this line have to carry can be carried safely by the aluminum and advantage can therefore be taken of a lighter conductor. Since this line was constructed, steel cored aluminum cables have been put on the market and have been used with great satisfaction by several power companies. The steel cored cable is much heavier for the same conductivity but has a very much higher tensile strength than hard drawn copper.

The conductors used have a cross sectional area of 270,000 c.m. consisting of 19 strands, an elastic limit of 14,000 lb. per sq. in., an ultimate strength of 24,000 lb. per sq. in. and weighs 1315 lb. per mile.

The Towers.

In a distribution line where the amount of power to be transmitted is small and where owing to the



Details of Towers.

revenue being in proportion the cost must be kept down in order that the line may earn a dividend, cedar poles have to be used. Cedar poles however are very inflammable and are easily set on fire. A spark from

a brush, timber or other kind of fire settling in a weather crack is liable in dry weather to start the pole smoldering and once started it will continue to smolder or burst into flames and the result is a burnt off pole. A leaky insulator may start a fire in a pole top or the charging current due to the insulator acting as a condenser may do the same with the result that when the pole top is burnt off the wire is allowed to fall and cross with other wires of the circuit. These are perhaps the principal reasons why the conductors of Tie Lines such as the one we are considering are usually supported on steel towers

The generally accepted type of tower at the time this line was designed was that having two circuits, one on each side of the tower, the conductors of each being in an approximately vertical plane. That was the type adopted in this case.

The specifications called for a tower to resist the following stresses. Each cross arm a horizontal strain, in any direction, of 5000 lb. and a vertical strain of 1000 lb. each applied at the end of the crossarm. Each ground wire support a horizontal strain in the direction of the line of 8000 lb. and a vertical strain of 1000 lb. Each tower the overturning moment due to a horizontal strain in the direction of the line of 5500 lb. applied at either ground wire support; also a horizontal strain in any direction of 3000 lb. applied at the point of support of any three of the conductors.

Each tower the overturning moment due to a horizontal strain in the direction of the line applied at each ground wire support of 5000 lb., also to a horizontal strain at right angles to the line applied at each ground wire support of 5000 lb.; also to a horizontal strain in the direction of the line applied at the intersection of the middle cross-arm and the center line of the tower of 9000 lb., and simultaneously a horizontal strain at right angles to the line applied at each of the points of support of the six conductors and two ground wires of 500 lb.; also to a horizontal strain either at right angles or parellel to the line applied at the center of gravity of all the wires of 12,000 lb. Accompanying the above mentioned horizontal stresses a vertical strain applied at the supports of each of the six conductors and two ground wires of 500 lb.

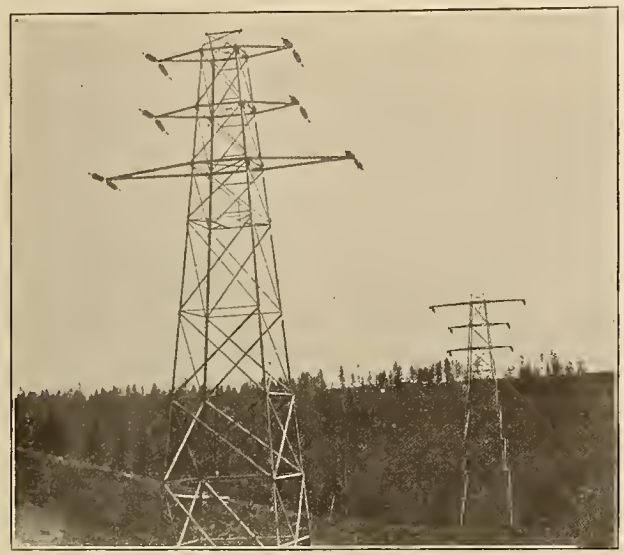
The stresses due to its owns weight and to a wind pressure in a horizontal direction of 20 lb. per sq. ft. on the superficial area of the tower.

All members of the towers were galvanized and bolted together. The standard tower is fifty feet from



Map Showing 60,000 Volt Lines of the Washington Water Power Company.

the ground stub joint to the bottom wire at the insulator and 192 of these towers weighing 5324 lb. each were used. In addition there were 10-40 ft. towers 4315 lb. each, 10.60 ft. towers 6390 lb. each, and 16

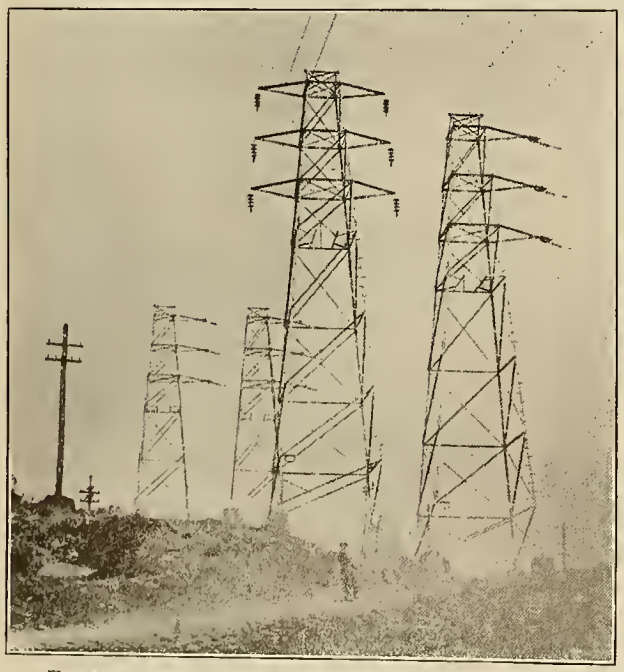


View of Tower Line Showing Transposition.

transposition towers 6467 lb. each. The line is transposed through 120 degrees eight times giving three complete cycles, and two towers are required for each transposition.

One hundred and eighty-five towers had anchor posts set in dirt and 43 anchor plates resting on concrete footings but anchored through the footings to solid rock by means of wedge holding down bolts.

The work of manufacturing the towers was done



Towers at Little Falls Showing Rock Anchorages.

under the supervision of an inspector employed by the purchaser, who kept a close supervision of the workmanship and made frequent tests on samples selected by him. One of the 50 ft. towers was erected at the contractor's works for inspection and to prove the correctness of the design was subjected to all the stresses provided for in the specifications.

Ground Wires.

Two ground wires are provided and they are attached both mechanically and electrically to the top of the towers. Each ground wire consists of a 3/8 in. diam., seven strand Siemens-Martin steel cable having an ultimate strength of about 9000 lb. and an elastic limit of 5500 lb. These ground wires are provided to afford protection from lightning discharges. Whether they do or do not furnish this protection the author is unable to state, from his own experience, but believes that they do. Many engineers claim that owing to the ground wires in each span together with the towers and the earth forming a closed circuit they thereby tend to choke down any high frequency surges that may come on the line. If this theory is correct and it probably is, then the ground wires are performing a duty beyond what was expected of them. In the design of the towers no consideration was given to the value of the ground wires acting as guys. The author believes this should be done and if it is the weight of the towers would be materially reduced.

Insulators.

It is generally conceded by engineers that on account of the potential gradient 60,000 volts is about the dividing line between pin type and suspension type insulators, though there is by no means a complete unanimity on this point. However, apart from the question of potential gradient there are mechanical features that make the suspension type the better one for use with long spans.

Before deciding on the type of insulator to be used, V. H. Greisser, electrical engineer of the company, and the author were privileged, through the courtesy of the Butte Electric & Power Company, to witness and participate in tests of a number of different types of suspension insulators. As a result of data gathered from these tests the Ohio Brass type of insulator was adopted for use on this line. Each suspension consists of four units and each strain insulator of five units.

The specifications provided that the insulators should have all corners both of the porcelain and the hardware to be rounded off and be smooth; the design was to be such as to prevent internal strains during the process of cooling of the porcelain; and all porcelain was to be completely vitrified and except where the porcelain surface was to come in contact with cement was to be glazed with a slate glaze.

The hardware was to be cemented to the porcelain with a good quality of neat Portland cement or concrete made of one part Portland cement and not to exceed one part of clean sharp sand.

The specifications called for the following inspections and tests:

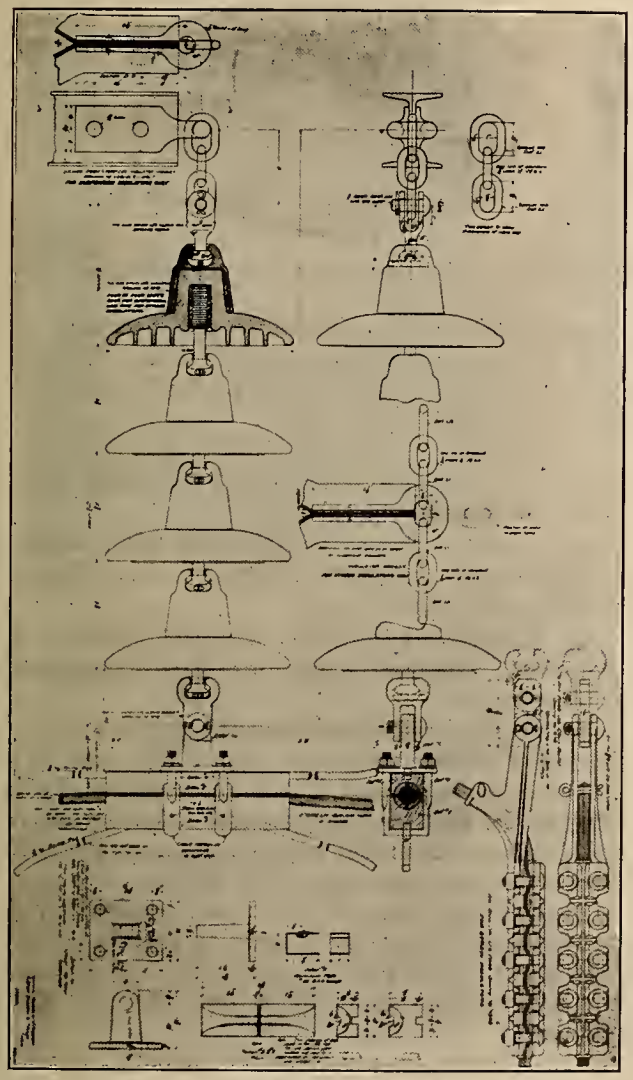
1. Design tests on a limited number of insulators (not over one per cent of the total) to determine their ultimate mechanical and electrical strength consisting of

A. Mechanical inspection of separate parts.
B. Electrical tests of separate parts.
C. Mechanical inspection of assembled insulators.
D. Electrical tests of assembled insulators.
E. Mechanical tests of assembled insulators.
F. Special tests which might be decided upon later.

2. Acceptance tests on all insulators consisting of:
G. Mechanical inspection of separate parts.
H. Electrical tests of separate parts.
E. Mechanical inspection and tests of assembled insulators.
J. Electrical tests of assembled insulators.

The specification went into very full details as to how these tests were to be made, but a summary, for four units to a string is as follows:

Dry test over 250,000 volts.
Wet test over 178,000 volts.
Ultimate tensile strength 10,000 lb.



Details of Insulators, Clamps and Arcing Rods.

It will be noted that this gives a factor of safety against flashover wet of considerably over two.

Cable Clamps.

The question of a suitable cable clamp was given full consideration and the clamp finally adopted was one designed by R. A. Willson, general superintendent of street railway system of the company.

The clamp, a patent for which has been issued, consists of two hard wood blocks, dipped in oil and lamp black, which by means of two clevises clamp the wire.

This clamp offers several advantages over the all-metallic clamp. There is practically no chance of injuring the cable, when tightening up the clamp, as the wood blocks only, with the exception of a thin aluminum strip, come in contact with it. The clamp can be adjusted so that the cable, should it be subjected to a stress in excess of the elastic limit will slip through; by thus pulling through of the cable the stresses on the tower will be materially relieved in case a cable should break. The aluminum strip above referred to is intended to keep the insulator hardware to which the clamp is attached at the same potential as the cable and prevent burning of the wood. The rod shown on the top of the clamp is an iron arcing rod provided to take the arc in case of a flashover and thus prevent the cable being burned off, the lower arcing rods were omitted.

[To be continued.]

POLE TIMBER POSSIBILITIES AND PREJUDICE.

Lodgepole pine, of which there are abundant stands in both the Rocky Mountain and Coast ranges, when treated with preservatives ought to serve with red cedar as a pole timber, says the department of agriculture in a bulletin just issued on Rocky Mountain woods for telephone poles.

The rapid extension of telephone and power lines in the west is making the question of pole supply one of increasing importance. Western red cedar, for long the standard pole timber of the western states, grows only in Washington, Oregon, and northern Idaho, and in the states south of that region its cost is much higher, owing to the great distance over which it must be transported. In addition, the heavy drain on the supply promises to result in increasingly higher prices.

The tendency of lodgepole pine to decay rapidly when in contact with the ground has so far kept it out of the field as a competitor of the cedar, but the general adoption of preservative treatment by railroad and telephone companies changes the situation. At an additional cost for treatment that still leaves the pine pole the cheaper of the two in most markets outside the cedar region, states the department, the pine may be made to last longer than untreated cedar. Tests carried on at the forest service laboratory also showed lodgepole pine to be as strong as the cedar, if not actually stronger.

Fire-killed lodgepole pine, of which there is a vast quantity in the Rocky Mountain region, showed a strength under test 80 per cent that of live red cedar. In elastic values, the two were practically equal, and in stiffness, fire-killed lodgepole pine is quite comparable to the cedar. The prejudice against the use of fire-killed material is a mistaken one, says the department, for there is no inherent difference in wood seasoned on the stump and wood cut when green and then seasoned. On many areas such material remains entirely sound for a number of years after the fire which killed it and besides is thoroughly seasoned and thus ready for preservative treatment as soon as cut.

Engelmann spruce is another Rocky Mountain tree which the department suggests might be used for poles. It is not as strong as lodgepole pine, nor does it take preservative treatment as well, but it grows farther south, and in many districts is the only local timber available for pole use.

METERING DIRECT CURRENT POWER WITH CURRENT TRANSFORMERS.

BY OTTO A. KNOPP.

The metering of electric power has been a matter of great importance since the first days of electric power distribution. It has been an international engineering problem, engaging some of the keenest minds in the engineering world.

The successful solution of the problem is also a matter of great financial importance, which is better understood when it is learned that the expense incurred by an electric distribution company through

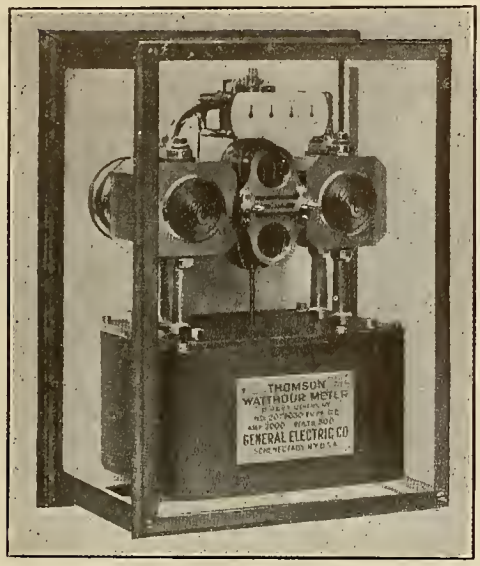


Fig. 1. Typical American High Capacity d.c. Meter.

their metering equipment is on par with the cost of the total generating equipment.

The problem may be divided into two distinct classes. The metering of alternating current power

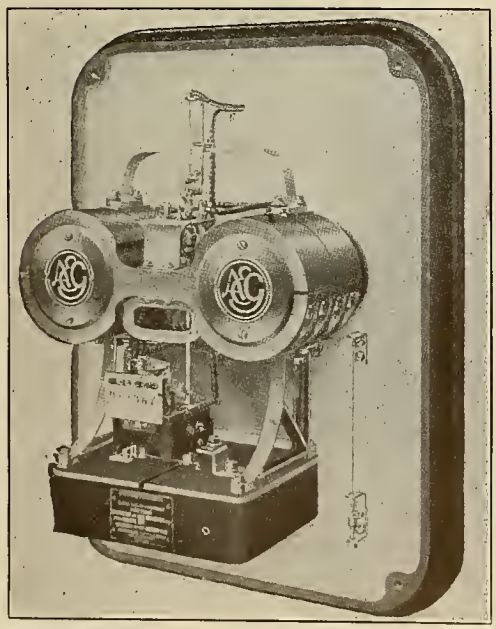


Fig. 2. Typical German High Capacity d.c. Meter.

and that of direct current power. The first problem has found in recent years a most satisfactory solution for all classes of service in the development of the small and inexpensive induction type meter in connection with the current and potential transformer. The induction meter proper is used ordinarily for small currents up to 400 or 500 volts pressure; for large currents and higher potentials, the current and potential transformer is used making it possible to meter large

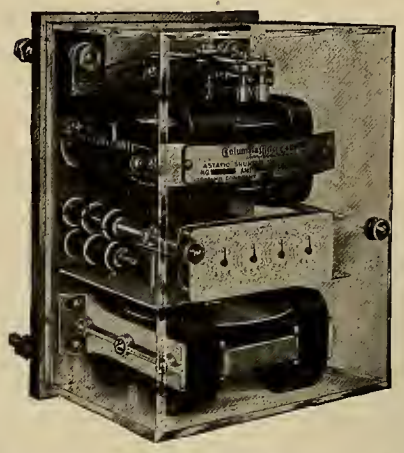


Fig. 3. Meter Designed for Shunt Operation.

volumes of power with good commercial accuracy with a small unit meter of 5 amp. and 110 volt capacity.

The problem of metering d.c. power has so far not found as satisfactory a solution.

The large electric manufacturing firms here and in Europe are still turning out direct connected meters for even the largest capacities.

Fig. 1 shows a typical American high capacity d.c. switchboard watthour meter of the Thomson Commutator or Meter Type.

Fig. 2 shows a typical German high capacity d.c. switchboard watthour meter of the dynamometer oscillating type.

For large currents above several hundred amperes such meters become very expensive in first cost, in installation cost and in cost of maintenance and testing. To reduce the cost of direct current metering numerous efforts have been made to use small capacity meters for operation in connection with shunts.

Fig. 3 shows a meter which was particularly designed for shunt operation possessing iron in its moving element to get a high torque and at the same time a low drop in the series fields necessary for shunt operation.

Fig. 4 illustrates another type of shunt operated meter with the particular feature of a four pole field.

Fig. 5 illustrates a meter which is naturally fitted for shunt operation; it is a mercury type meter possessing a very low drop in the series field. It has been used advantageously not only for small installations, but practically for the very largest direct current meter installations.

If we compare the use of the shunt in connection with direct current meters, with the current transformer used in connection with the induction meter, we find that the shunt possesses greater disadvantages over the current transformer. The accuracy of the shunted meter is more or less affected by relative temperature changes between meter and shunt or any other relative change of resistance between shunt and meter produced either through change in length of lead or change in contact resistance, etc., whereas

the current transformer together with induction meter are practically not affected by such changes, at the same time the current transformer remains comparatively inexpensive up to the largest capacities, whereas the shunt becomes very expensive in first cost, cost of installation and cost of power lost in its resistance in order to produce the necessary drop.

caused to flow from the secondary d.c. source of power, producing a flux which tends to neutralize the primary flux and this secondary current does not stop rising until the flux in the core has become zero, in which instance the contact of the armature is broken and by a simple process of contacting, the spell of which depends upon the time element of the secondary

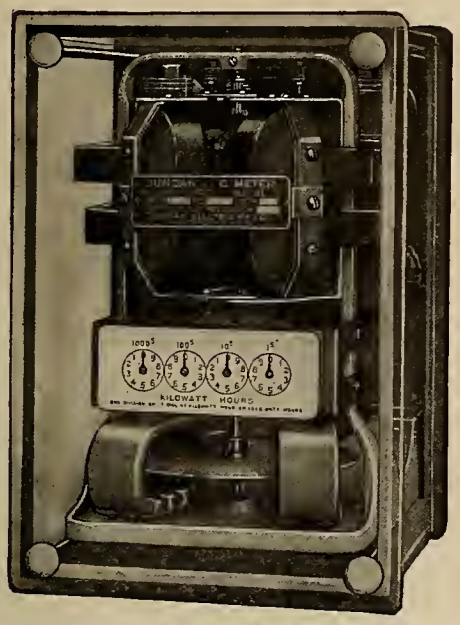


Fig. 4. Shunt Operated Meter With Four Pole Field.

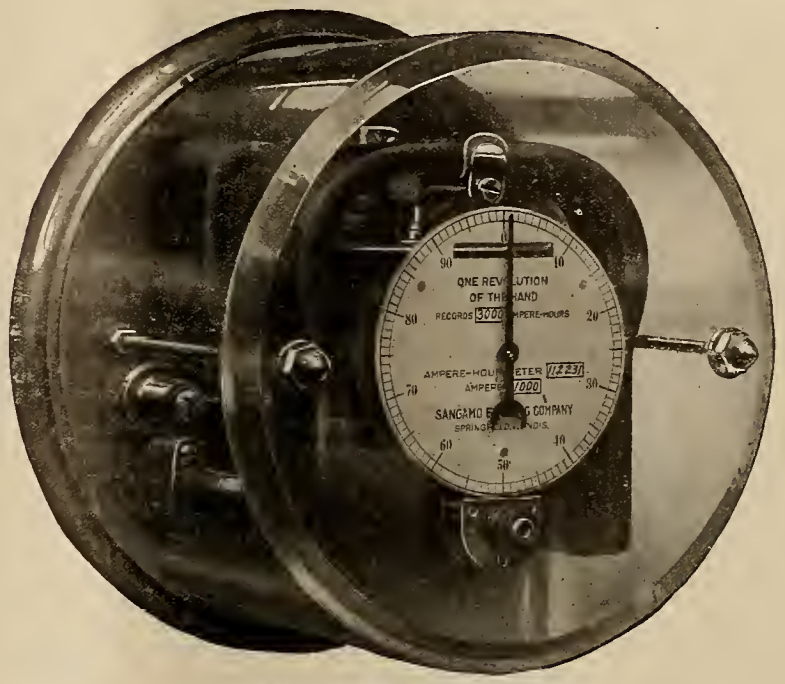


Fig. 5. Mercury Type Meter.

Up to the present time the shunted meter if properly designed and installed is probably the best and least expensive meter for metering large amounts of d.c. power; but not so much from the standpoint of initial accuracy as from that of easily maintaining a fair accuracy.

The trend of further development in direct current metering lies therefore in the development of a piece of apparatus which is the counterpart of the a.c. current transformer.

An automatic ratio relay recently patented by the writer adapts itself admirably to the above mentioned purpose; it may be in some respects called a d.c. current transformer, for practically and theoretically, it performs the function of the well-known a.c. current transformer. It may interest some of the readers to know the theory of its construction.

It is well known that in the a.c. current or series transformers the primary series or line current produces a flux in the iron core which flux, with the secondary of the transformer closed, becomes almost completely neutralized by the secondary current, the lower the resistance and impedance in the secondary circuit, the nearer will be the flux to zero and the more closely will be the ratio of primary to secondary current equal the ratio of turns of the transformer. If we send a direct current through the primary of the d.c. current transformer a flux will be produced in the core of the latter. This core has a small air gap in which a light contacting armature is mounted. This armature is drawn against a contact as the flux begins to rise and in the same instant a secondary current is current producing element, a secondary current is produced which is exactly in ratio of turns equal the primary current.

Such a current ratio relay can be applied just like an a.c. current transformer and has the following advantages:

First. It possesses a uniform ratio throughout its whole range.

Second. The ratio is independent of the secondary load.

Third. The measuring instrument in the secondary can be installed at any distance.

Fourth. The power for operating the measuring instrument is supplied from a secondary source, therefore no drop introduced in the primary circuit and no power consumed out of the primary circuit. (Shunt losses in case of shunt operated meters often amount to several kw. in a single large d.c. meter installation.)

Fifth. The reluctance of the magnetic circuit does not affect the accuracy of the ratio relay, therefore the core can be split and slipped over the conductor without that the ratio can be affected by an imperfect magnetic closure.

Sixth. Without interrupting the circuit measurement can be made of currents flowing in lead covered cables and busbars (distribution currents), pipes and rails (railway return currents), steel girders (electrolysis currents), etc.

Possessing all the above advantages it would seem that the ratio relay is destined to play a more or less important part in the field of direct current measurement.

ELECTRICAL CONTRACTORS' DEPARTMENT

IS UNDERWRITERS' INSPECTION NECESSARY IN OREGON?

BY F. D. WEBER.

[Continued.]

To combat this waste of resources and "conserve our wealth," there was organized in 1895 the National Fire Protection Association. The purpose of the association is to to make standards under guidance of which the fire waste may be checked and to educate the people to the observance of those standards.

Prior to this in 1881, the underwriters' attention was forcibly called to the necessity of electrical inspection, due to the fact that 26 electrical fires occurred in six months in the 65 textile mills of New England. Immediately local rules to handle the situation were formulated, from which grew the National Electrical Code as we have it today, being first adopted as such in 1896.

The code was made by representatives of the various electrical and insurance interests and is amended by a similar representative body. This committee is now known as the Electrical Committee of the N. E. P. A., which meets annually. This is an open meeting and every person and interest is invited to participate.

The "Fire Hazard" of electrical installations and apparatus, has been the fundamental reason for the formulation of Code Rules, but the feeling has now become quite prevalent among all interests represented that "life hazard" should also be considered and we have several rules, in the last edition of the National Electrical Code, which take this into consideration in a definite manner.

It would be useless to have rules for the proper method of installing electrical conductors and apparatus if there were no minimum standard by which to manufacture the various electrical materials and apparatus in order that the fire hazard be eliminated as much as possible. This fact was appreciated very early in the history of the N. E. C., but not until 1894 were any steps taken to found an institution which would approve or criticize materials or apparatus which manufacturers deemed proper for use and desired to sell to the general public. The institution founded is the Underwriters' Laboratories, Inc., 207 E. Ohio street, Chicago, Ill.

The inspections made by the Underwriters' Laboratories, Inc., are based upon standard rules and requirements recommended by the National Fire Protection Association and therefore do not represent arbitrary or personal judgment on the various subjects.

The Laboratories criticize or approve a vast amount of things as shown by the three lists the National Board of Fire Underwriters publish based on their investigation.

List of appliances which are as follows:

(1) List of fire appliances, covering devices, materials and apparatus which may be of service in retarding, extinguishing or indicating fires.

(2) List of electrical fittings, covering devices and materials acceptably safeguarded for use in electric lighting and power equipments.

(3) List of gas, oil, mechanical and chemical appliances, covering hazardous devices, materials and apparatus which are safeguarded in an acceptable manner.

The National Board of Fire Underwriters publishes the following:

List of Rules, Requirements and Specifications.

Acetylene Gas Machines and Storage of Calcium Carbide.
Coal Gas Producers.
*Fire Alarm Systems—Municipal.
Fire Departments—Private—Suggestions for Organizing.
Fire Doors and Shutters.
Fuel Oil, Storage and Use.
Gas and Gasolene Engines, Construction and Installation of.
Gasolene Vapor Gas Lighting Machines, Lamps and Systems.
Gasolene Stoves for Cooking and Heating.
Grain Dryers, Construction and Installation of.
Gravity Tanks, Construction and Installation of.
Hose Couplings and Hydrant Fittings for Public Fire Service, with Details and Dimensions of the National Standard.
**Hose, Private Department, Fire, for Mill Yard Use.
**Hose, Fire Department Use.
Hose Houses for Mill Yards, Construction and Equipment of.
Hose, Unlined Linen, Manufacture of.
Hydrants for Mill Yard Use. (See Valves, Indicator Posts and Hydrants.)
Incubators and Brooders, Construction and Installation of.
Kerosene Oil Pressure Systems, Construction and Installation of, for Lighting and Industrial Uses.
Lightning, Protection Against.
**National Electrical Code.
Nitro-Cellulose Films, Storage and Handling of.
Oxy-Acetylene. Heating and Welding Apparatus.
**Pumps, Centrifugal Fire.
Electric Fire.
Rotary Fire.
Steam Fire.
Governors and Auxiliary Pumps (Steam).
Railway Car Storage and Operating Houses, Construction and Protection of.
**Signaling Systems Used for the Transmission of Signals Affecting the Fire Hazard.
Skylights, Construction and Installation of.
Sprinkler Equipments, Automatic and Open Systems, Installation of.
Storage Systems for 250 Gallons or Less of Fluids which at Ordinary Temperature give off Inflammable Vapors.
Uniform Requirements (Mill Construction, Inferior Construction), General Hazards, Oil Rooms, General Protection, Stair and Elevator Enclosures, Watchmen, Thermostats, etc.
Valves, Indicator Posts and Hydrants for Mill Yard Use.
Waste and Safety Cans, Fire Pails, etc.
Wired Glass and Construction of Frames for Wired and Prism Glass Used as a Fire Retardant, Manufacture, Construction of.
*New Publication. **Revised.

List of Approved Devices.

(Published under one cover—pamphlet known as "List of Manufacturers of Fire Appliances.")

Alarm Valves.
Building Material.
Doors, Corridor or Partition.
Doors, Stair and Elevator.
Doors and Shutters.
Dry Pipe Valves.
Extinguishers, 2½ Gallon, Hand Chemical.
Extinguishers, Miscellaneous
Extinguishers on Wheels, Chemical, 40 Gallons.
Fire Alarms, Automatic (Thermostats).
Fusible Links
Heat Insulating Coverings.
Hardware for Doors and Shutters.
Hose, Cotton Rubber Lined.
Hose, for Chemical Fire Extinguishers.
Hose, Unlined Linen.
Hose Racks.
Hydrants.
Paints, Fire Retardant.
Play Pipe.
Post Cap and Girder Supports.
Pump Governors.
Receptacles (Safety Cans).
Shop Equipment.
Signal and Fire Alarm Systems, Bells for.
Sprinklers, Automatic
Sprinkler Supervisory Devices.
Wall Hangers (Steel).
Waste Cans.
Watchman's Time Recording Apparatus.
Window Frames for Wired Glass.
Window Hardware, Sash Locks, Chains.
Wired Glass.
Wired Glass for use with Burglar Alarm Equipments.

(Published under one cover—pamphlet known as "List of Gas, Oil and Chemical Appliances.")

Acetylene Generators.
Lamps.
Service Tanks.
Cleaning Fluids.
Dust Cloths.
Engines, Fuel Oil.
Gas.
Gasolene, Stationary.
Gasolene, Portable.
Film Box.
Floor Brush.
Fuel Kindler.
Gas Heaters.
Producers, Suction.
Regulators.
Gasolene Gas Machines.
Hose.
Lighting Systems, Class C and Class E.
Oil Distribution Systems, Class C.
Gasolene Stoves.
Vapor Lamps.
Incubators and Brooders.
Kerosene Kiln.
Oil Pressure Systems.
Lime, Slaked.
Liquid Gas Apparatus.
Pitching Plants.
Polish.
Storage Systems, Inside Discharge.
Isolated.
Portable Tanks.
Inside Discharge System Pump.
Stationary Tanks in Buildings.
Underground Tanks.
Sweeping Compounds.
Unions.
Watchmen's Lantern.

Published in book form.

Electrical Fittings.

These lists are revised semi-annually and besides this on the payment of $15.00, a system of card index is furnished any one so desiring it, which is kept up to date by addition of cards mailed each week.

In order that approved apparatus may be known in the field, the label system is used. Labels of distinctive design are attached to the product approved, by which approved articles are easily identified. Other materials are listed under manufacturer's name and catalogue number.

One of the most efficient organizations of the Underwriters in the country, is the National Board of Fire Underwriters, which has been in active operation since 1866. The Board now numbers one hundred and twenty-five members, and its objects as stated in the constitution are as follows:

Purposes.

First: To promote harmony, correct practices, and the principles of sound underwriting; to devise and give effect to measures for the protection of the common interests, and the promotion of such laws and regulations as will secure stability and solidity to capital employed in the business of fire insurance, and protect it against oppressive, unjust and discriminative legislation.

Second: To repress incendiarism and arson by combining in suitable measures for the apprehension, conviction and punishment of criminals guilty of that crime.

Third: To gather such statistics and establish such classification of hazards as may be for the interest of members.

Fourth: To secure the adoption of uniform and correct policy forms and clauses, and to endeavor to agree upon such rules and regulations in reference to the adjustment of losses as may be desirable in the interest of all concerned.

Fifth: To influence the introduction of improved and safe methods of building construction, encourage the adoption of fire protective measures, with adequate and improved water systems, and establish rules designed to regulate all hazards constituting a menace to the business. Every member shall be in honor bound to co-operate with every other member to accomplish the desired objects and purposes of the Board.

At the time of its organization, and for a number of years thereafter, it was the rate-making association of the country, and in a large measure regulated commissions to agents. In 1877 it ceased to regulate rates, and in 1888 it absolved itself from the subject of commissions, and has since been actively concerned in all matters of common interest to the companies and the insuring public. Its membership is composed of union and non-union companies, and its meetings afford opportunity for all classes of companies to meet on common ground and discuss and act upon matters for the best interests of all.

"In a word, the work of the Board is almost entirely of an educational, engineering and public service character and its influence toward uniformity and better practices commands the attention and commendation of both the insurer and the insured. Indeed, few realize the extent of the public service rendered by the National Board of Fire Underwriters, and its efforts to conserve property and lives from the danger of fires; nor is it generally known that the fire insurance companies annually expend, in one way or another, a sum of $3,300,000 in this public service work."

[To be continued.]

THE FERRIS WATER POWER BILL.

(Mr. Ferris introduced the following bill in the House of Representatives, March 21, 1914, when it was referred to the Committee on the Public Lands and ordered to be printed. It is stated to be an administration measure and that its passage is anticipated.—The Editors.)

To provide for the development of water power and the use of public lands in relation thereto, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of the Interior be, and hereby is, authorized and empowered, under general regulations to be fixed by him, to lease any part of the lands and other property of the United States (including Alaska), reserved or unreserved, including lands in national forests, national monuments, military and other reservations, not including national parks, for a period not longer than fifty years for the purpose of constructing, maintaining, and operating dams, water conduits, reservoirs, power houses, transmission lines, and other works necessary or convenient to the development, generation, transmission and utilization of hydroelectric power, which leases shall be irrevocable except as herein provided, but which may be declared null and void upon breach of any of their terms: Provided, That such leases shall be given within or through any of said national forests, military or other reservation only upon a finding by the chief officer of the department under whose supervision such forest, park, or reservation falls that the lease will not injure, destroy, or be inconsistent with the purpose for which such forest, park, or reservation was created or acquired: Provided further, That in the granting of leases under this act the Secretary of the Interior may, in his discretion, give preference to applications for leases for the development of electrical power for municipal uses and purposes.

Sec. 2. That each lease made in pursuance of this Act shall provide for the reasonable development and continuous operation of the water power, and may provide that the lessee shall at no time, without the consent of the Secretary of the Interior, contract for the delivery to any one consumer of electrical energy in excess of fifty per centum of the total output.

Sec. 3. That in case of the development, generation, transmission and use of power or energy under such a lease in a territory, or in two or more states, the regulation and control of charges for service to consumers is hereby conferred upon the Secretary of the Interior or committed to such body as may be later provided by Federal statute: Provided, That the physical combination of plants or lines for the generation, distribution, and use of power or energy under this Act or under leases given hereunder may be permitted, in the discretion of the Secretary, but combinations, agreements, arrangements, or understandings, express or implied, to limit the output of electrical energy, to restrain trade with foreign nations or between two or more states or within any one state, or to fix, maintain, or increase prices for electrical energy or service is hereby forbidden.

Sec. 4. That no lease issued under this Act shall be assignable or transferable, and no sale or delivery of power to a distributing company shall be made, except upon the written consent of the Secretary of the Interior.

Sec. 5. That after not less than three years' notice the United States shall have the right at any time, from and after fifty years from the date of any lease issued hereunder, to take over the properties which are dependent, in whole or in part, for their usefulness on the continuance of the lease herein provided for, which may be acquired by any lessee acting under the provisions of this act, upon condition that it shall pay, before taking possession, first, the actual cost of rights of way, water rights, lands, and interests

therein purchased and used by the lessee in the generation and distribution of electrical energy under the lease, and, second, the reasonable valuation of all other property taken over, including structures and fixtures acquired, erected, or placed upon the lands and included in the generation or distribution plant, and which are dependent as hereinabove set forth, such reasonable values to be determined by mutual agreement between the Secretary of the Interior and the lessees, and, in case they can not agree, by proceedings instituted in the United States circuit court for that purpose: Provided, That such reasonable valuation shall not include or be affected by the value of the franchise or good will or any other intangible element.

Sec. 6. That in lieu of taking over, maintaining, and operating the properties, as provided in section five hereof, the United States may, at its option, and at the same time and under the same conditions prescribed in said section five, take over and lease the same to another lessee upon such terms, under such conditions, and for such periods as applicable laws may then authorize, upon the condition that the new lessee shall first take over, acquire, and pay for the properties of the first lessee, under the condition and in form and manner provided in section five hereof, or at the option of the United States the lease may be renewed to the original lessee, upon such terms and conditions and for such period as may be authorized under the then existing applicable laws.

Sec. 7. That where, in the judgment of the Secretary of the Interior, the public interest requires or justifies the execution by any lessee of contracts for the sale and delivery of electrical energy for periods extending beyond the life of the lease, such contracts may be entered into upon the approval of the said Secretary, and thereafter, in the event of the exercise of the option of the United States to take over the plant in the manner provided in sections five or six hereof, the United States or its new lessee shall assume and fulfill all such contracts entered into by the first lessee.

Sec. 8. That for the occupancy and use of lands and other property of the United States permitted under this act the Secretary of the Interior is authorized to fix in the lease and collect charges or rentals for all power developed and sold or used by the lessee for any purpose other than the operation of the plant, the proceeds to be used and disposed of, so far as may be necessary, in payment of the cost of administration of this act and of leases or permits thereunder, and the surplus over such cost of administration shall be paid into, reserved and appropriated as a part of the reclamation fund created by the act of congress approved June seventeenth, nineteen hundred and two (Thirty-second Statutes at Large, page three hundred and eighty-eight), and after use thereof in the construction of reclamation works and upon return to the reclamation fund of any such moneys in the manner provided by the reclamation act, fifty per centum of the amounts so utilized in and returned to the reclamation fund shall be paid by the Secretary of the Treasury after the expiration of each fiscal year to the state within the boundaries of which the hydroelectric power or energy is generated and developed, said moneys to be used by such state for the support of public schools or other educational institutions or for the construction of public improvements, as the legislature of the State may direct.

Sec. 9. That the provisions of this act shall apply only to such states as have provided or which may provide a commission or other authority having full power to regulate rates and service of electrical power; and no lease or disposition of lands shall be made under this act in any state wherein such authority has not been provided by law.

Sec. 10. That where the Secretary of the Interior shall determine that the value of any lands, heretofore or hereafter reserved as water power sites or for purposes in connection with water power development or electrical transmission, will not be destroyed for such purposes by either location, entry or disposal, the same may be allowed under applicable land laws upon the express condition that all such locations, entries, or other methods of disposal shall be subject to the sole right of the United States and its authorized lessees or grantees to enter upon, occupy, and use any part or all of such lands reasonably necessary for the accomplishment of all purposes connected with the development, generation, transmission or utilization of power or energy, and all rights acquired in such lands shall be subject to a reservation of such sole right to the United States, its lessees or grantees, which reservation shall be expressed in the patent or other evidence of title: Provided, That locations, entries, selections, or filings heretofore allowed for lands reserved as water power sites or in connection with water power development or electrical transmission may proceed to approval or patent under and subject to the limitation and conditions in this section contained, but nothing herein shall be construed to deny ar abridge rights now granted by law to those seeking to use the public lands for purposes of irrigation or placer mining alone.

Sec. 11. That the Secretary of the Interior is hereby authorized to require lessees to submit statements, representations, or reports, including information as to cost of water rights, lands, easements, and other property acquired, production, use, distribution, and sale of energy, all of which statements, representations or reports so required shall be upon oath, unless otherwise specified, and in such form and upon such blanks as the Secretary of the Interior may require; and any person making any false statement, representation, or report under oath shall be subject to punishment as for perjury.

Sec. 12. That any such lease may be forfeited and canceled, by appropriate proceedings only, in a court of competent jurisdiction whenever the lessee, after reasonable notice, as prescribed in the lease, shall fail to comply with the terms of this act or with such conditions not inconsistent herewith as may be specifically recited in the lease.

Sec. 13. That the Secretary of the Interior is hereby authorized to perform any and all acts and to make such rules and regulations as may be necessary and proper for the purpose of carrying the provisions of this act into full force and effect.

Sec. 14. That all acts and parts of acts inconsistent herewith are hereby repealed.

Reversal of a Railroad Commission order was effected by a decision of the Supreme Court of the State of California, written by Justice Lucien Shaw, during the past week. In April, 1913, the California Railroad Commission refused permission to the Oro Electric Corporation to exercise a franchise privilege granted by the municipality of Stockton, on the grounds that public convenience and necessity did not demand competitive systems in that city. The court now rules that the power granted to the commission by the public utilities act to grant certificates of public convenience and necessity is unconstitutional as applied to municipalities, unless the necessary powers are voluntarily surrendered by the municipalities to the commission. This decision is of great importance in that it curtails the power and jurisdiction of the Railroad Commission, reverses what the commissioners thought to be the law, and gives to municipalities the right to regulate utilities to which they have granted franchises.

SPECIFICATIONS FOR WESTERN CEDAR POLES.

(Readers interested in the proposed Western Red Cedar Pole Specifications published in our March 7, 1914, issue and also referred to editorially in that number, have asked for the publication of specifications still more complete that the discussion may be taken up from all angles. A further specification is given herewith. It is definitely stated that the National Electric Light Association will include the western forest products in official specifications to be published this year.—The Editors.)

The material desired under these specifications consists of poles and guy stubs of the best quality of either seasoned or live green cedar of the dimensions hereinafter specified. The poles covered by these specifications are of Western white cedar, otherwise known as red cedar, Western cedar, or Idaho cedar. Seasoned poles shall have preference over green poles provided they have not been held for seasoning long enough to have developed any of the timber defects hereinafter referred to. All poles shall be reasonably straight, well proportioned from butt to top, shall have both ends squared, sound tops, the bark peeled, and all knots and limbs closely trimmed.

Dimensions.

The dimensions of the poles shall be in accordance with the following table, the "top" measurement being the circumference at the top of the pole, and the "butt" measurement, the circumference six feet from the butt. The dimensions given are the minimum allowable circumferences at the point specified for measurement and are not intended to preclude the acceptance of poles of larger dimensions.

When the dimension at the butt is not given, the poles shall be reasonably well proportioned throughout their entire length. No pole shall be over six inches longer or three inches shorter than the length for which it is accepted. If any pole is more than six inches longer that is required, it shall be cut back.

Minimum Dimensions of Poles in Inches.

Class .....A	B	C	D	E	F
Min. Top Cir..28	25	22	18½	15	12
Length of poles, ft.	Circumference 6 ft. from butt.				
20	30	28	26	24	
22	32	30	27	25	
25	34	31	28	26	
30	37	34	30	28	
35	40	36	32	30	No butt requirement.
40	43	38	34	32	
45	45	40	36	34	
50	47	42	38	36	
55	49	44	40	38	
60	52	46	41	39	
65	54	48	43		

Quality of Timber.

Dead Poles. No dead poles and no poles having dead streaks covering more than one quarter of their surface shall be accepted under these specifications. Poles having dead streaks covering less than one quarter of their surface shall have a circumference greater than otherwise required. The increase in the circumference shall be sufficient to afford a cross sectional area of sound wood equivalent to that of sound poles of the same class.

Twisted, Checked or Cracked Poles. No poles having more than one complete twist for every twenty feet in length, no cracked poles, and no poles containing large season checks, shall be accepted under these specifications.

Crooked Poles. No poles having a short crook or bend, a crook or bend in two planes, or a reverse crook or bend shall be accepted under these specifications. The amount of sweep measured between the six foot mark and the top of the pole, shall not exceed one inch to every six feet in length.

"Cat Faces." No poles having "cat faces" unless they are small and perfectly sound, and the poles have an increased diameter at the "cat face," and no poles having "cat faces" near the six foot mark, or within ten feet of their tops shall be accepted under these specifications.

Shaved Poles. No shaved poles shall be accepted under these specifications.

Wind Shakes. No poles shall have cup shakes (checks in the form of rings) containing heart or star shakes which enclose more than ten per cent of the area of the butt.

Butt Rot. No poles shall have butt rot covering in excess of ten per cent of the total area of the butt. The butt rot, if present, must be located close to the center in order that the pole may be accepted.

Knots. Large knots, if sound and trimmed close shall not be considered a defect. No poles shall contain hollow or rotten knots.

Miscellaneous Defects. No poles containing sap rot, woodpecker's holes or plugged holes, and no poles showing evidences of having been eaten by ants, worms, or grubs, shall be accepted under these specifications.

Marking. Every pole shall be scored with a (insert here company's distinguishing mark) at a point —— feet from the butt.

A government built, owned and operated railroad, the only one in the United States, is the Boise & Arrowrock Railroad, running from the terminus of a branch of the Oregon Short Line to the site of the Arrowrock Dam—the big dam now under construction on Boise River about 20 miles above Boise, Idaho. It is standard gauge, 17 miles in length, with maximum grades of one and one-half per cent, while the additional 2 miles of spur tracks have maximum grades of three per cent. The total cost of construction was about $20,000 per mile. Prior to the construction of the railroad cost of freight hauling by wagon was $8 per ton and the line was built because it was estimated that the saving in cost of freight on the cement alone would nearly pay for the construction cost. The rolling stock consists of two locomotives, two passenger cars, four flat cars, three box cars and a miscellaneous equipment of handcars, speeders and so forth. One round trip from Arrowrock to Barberton is made each week day, and two on Sundays. The cost per train mile of operating the road to the end of December, 1913, as stated in the Reclamation Record from which this article is abstracted, was $2.34, the minimum cost in one month amounting to $1.53 per train mile. The costs compare favorably with the average operating expenses per train mile of the far western roads, which in 1911 amounted to $1.58, while on several of the roads the expenses ran considerably over $3 per train mile. About 45,000 passengers have been carried to date, many of them sightseers who have welcomed the opportunity to make this scenic trip along the picturesque Boise River to the dam site, and to the huge structure being built there.

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POWER AND GAS

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Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advanace of date of issue.

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Obscuring The Issue

The salesman detected in a mis-statement of fact—one giving utterance only to near-truths which may possibly deceive—is distrusted. He loses the sale. All business must be based upon confidence. Cards held above the table. The game played fair. Otherwise that distrust which is dissolution hinders or halts the purpose planned.

In the southland of California an acute situation exists. A campaign is in progress having for its ultimate object condemnation of certain commercial public utility properties for municipal appropriation and use.

A municipal aqueduct built for the purpose of conveying water for domestic purposes to the city of Los Angeles is found also to be an available source of electric power generation sufficient for the present needs of the city. Whether or no power is developed by the aqueduct its cost as such would have remained constant. It is in the neighborhood of thirty-four million dollars.

Now it is proposed to vote an additional six and one-half million dollars in bonds to complete a power plant and distribution systems in connection with this project, or to acquire by condemnation proceedings the distribution systems of existing commercial utilities.

In their advertisements the advocates of this procedure state that the entire investment made will continue to be a heavy burden unless made to produce electrical energy. "Otherwise the aqueduct will remain idle."

If this gigantic project is not required for the purposes under which the city gained its water rights the question may well be asked "Was that primary purpose a stupendous blunder which it is now desired to cover by the generation of electric power?"

United States government statistics do not in general bear out the statement that "the distribution by the city of its own electricity will result in cheaper electricity in the homes," resulting in "lower electric light bills all over the city."

The excess cost of municipal service is given elsewhere in these editorial columns. The figures show that if commercial electric light and power plants make a profit of five per cent, then with the higher rates charged, those municipally owned should show a profit of more nearly fifty per cent. But the returns show the profits of commercial and municipal plants to be practically equal. This if you ignore the aphorism, that "Municipal plant profits are largely a matter of bookkeeping."

In face of the government statistics recently published it would be difficult to prove that condemnation of the commercial electric light and power plants in Los Angeles constituted a public necessity, but this proof would be required, as the mere necessity for making profit on an investment, rightly or erroneously made, is not sufficient of itself to justify condemnation.

The Journal holds no brief for the power companies in question, but it is only just and fair to them and to the Los Angeles public for us to point out that one of them has the highest load factor of all comparable companies in the United States; a measure of the unequalled service and educational effort put forth by that company in the past.

The management of the Los Angeles municipal plant would have to guarantee to "beat the best" in order to substantiate condemnation proceedings.

And as an incidental question it would be interesting to learn just how the city of Los Angeles purposes to reduce lighting rates to its citizens cumbered as it is with this burdensome and growing investment of forty million dollars which is to represent a development of only thirty-five thousand kilowatts.

All of which forcibly questions the accuracy of all the statements made as well as sincerity of those who say that the aqueduct investment is, in its entirety, chargeable to the electric light and power plant.

Business Hampering Bills

How long? The question is not new but is none the less insistent. "How long halt ye between two opinions?" Whether it be better to so hobble business enterprise that it cannot board the business buggy, or, on the other hand to give such freedom to business that the first step upward will be made possible and the car of commerce move onward with its freight of prosperity for the country at large? At least declare.

Fifty years ago, to hark back merely one period, Henry Ward Beecher speaking on the slave question and appealing to the Anglo-Saxon business instinct, said: "The things required for prosperous labor, prosperous manufacture and prosperous commerce are three: first, liberty; secondly, liberty; and thirdly, liberty.

"First, there must be liberty to follow those laws of business which experience has developed, without imposts or restrictions, or governmental intrusions. Business simply wants to be let alone."

And business today, as of old-time, simply wants to be let alone.

Legislation should encourage business and not hamper.

This comment is called forth by the introduction of yet another water power bill in the House of Representatives. It is stated to be an administration measure and its passage is therefore anticipated. To the West the measure is not desirable.

There seems to be no end to the making of unnecessary business hampering bills. Something always seems lacking, and their study is a weariness of the flesh.

This particular bill is said to have been "fathered" in Oklahoma and Missouri, where water power development is a curiosity and where municipal ownership of lighting plants, there at a maximum, results in an average revenue of approximately four cents per kilowatt hour as against less than half that amount under water power development by commercially operated plants in the West.

Why not the introduction of a water power code by a western member voicing a policy not inimical to business interests, not only of the West, but elsewhere?

A code which shall merely emphasize the state's control of these matters, with federal international exceptions; which eliminates dual authority; which by definite contracts encourages investment; limits the office of public officials to that of custody instead of rule; vests control of the business of the plants in the state; and, in view of the fact that the investor is not looking for abnormal profits from development enterprises but for a continuity of business, that this be made possible and that absolute protection be afforded the investor, especially in view of the allowance only of a reasonable, which is interpreted, "limited" rate of return.

There is an opportunity for someone to proffer such a program and in the interests of a comparative industrial liberty, to prosecute its adoption.

Municipal Plants' Power Rates

Municipal ownership of public utilities is favored because of certain advantages which will accrue to the people; the most important always being that which appeals to the pocket namely, a reduction in rates. The value of such a "reduction" should first be noted for if statistics show that this is actually brought about the worth of the reduction is an important factor in deciding the desirability of municipal ownership.

The expenditure of the average citizen for utility service approximates ten per cent of his income, about two per cent being spent for light.

The city lighting plant, the latest bauble of the public craze, might therefore be made to save this average citizen the expenditure of one per cent of his income by reducing his lighting bill fifty per cent.

But statistics issued by the Bureau of the Census, and recently made public, point to the fact that the municipal electric light plant is non-successful in effecting reductions.

The average revenue per kilowatt hour output of municipal plants shows an increase during the past ten years of 21 per cent. During the same period that of the commercial plants decreased 28 per cent; this revenue per kilowatt hour of municipal plants being 80 per cent higher than that of the commercial plants in 1912.

On this basis municipal ownership would have cost the people of the United States on their requirements for 1912, over two hundred million dollars more than it did. The apparent excess cost, however, was ten million dollars, as the municipal plants, though nearly 30 per cent of the total, represent less than five per cent of the output of all stations.

There may be an excess of less profitable municipal business. But why? Does not this emphasize the further fact, dealt with more fully in a recent editorial, that any small saving to each consumer which might possibly result from municipal ownership is more than off-set by arrested development and lack of enterprise in other directions. These cause even greater losses.

The figures given are not final, or applicable to any locality any more than is the statement that municipal ownership because successful in one place must necessarily be successful in another.

They do however, reasonably suppose the existence of concrete arguments which should be advanced against municipal ownership in general and urge the introduction of cogent analysis to take the place of superficial statements, based upon the possibilities or impracticableness of municipal ownership in the United States because of its success or failure abroad.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

James T. Lea has joined the sales force of the Great Western Power Company at Oakland, Cal.

Wm. Henning, superintendent Desert Power & Water Company, Kingman, Arizona, is at San Francisco.

Leroy C. Bishop has been appointed general manager of the Berkeley Electric Cooker Company, Berkeley, Cal.

C. A. Hunt, manager of the Hunt Electric Company of Santa Cruz, Cal., was at San Francisco during the past week.

H. D. Brainard, sales manager of the Western Electric Company at Seattle, is making a tour of Washington and Oregon.

J. A. Nadon of the Westinghouse Electric & Manufacturing Company, San Francisco, was at Reno, Nev., during the past week.

M. G. Carhart, power apparatus specialist for the Western Electric Company at Seattle, is spending a week in Oregon territory.

Walter S. Van Winkle, power salesman with the Great Western Power Company, joined the ranks of the benedicts at Berkeley on April 15th.

Bertram Smith, assistant manager Edison Storage Battery Supply Company, San Francisco, has left for a trip to Los Angeles and San Diego.

F. G. Baum, consulting engineer Pacific Gas & Electric Company, San Francisco has been transferred to the grade of Fellow of the American Institute of Electrical Engineers.

L. Bartlett distribution engineer with Henry L. Doherty Operating Company, New York City, is visiting the Pacific Coast looking over local properties and spent last week in San Francisco.

Mort H. Dodge, district manager of the Standard Electric Time Company, with headquarters at Seattle, Washington, is at Salt Lake City supervising the installation of time service clocks for his company.

H. L. Vorse, assistant electric inspector of the Underwriters' Equitable Rating Bureau, Portland, Oregon, has been in poor health for the past three months, but is now recuperating on a ranch near Prineville, Oregon.

Victor E. Thurman, formerly with the Richfield (Utah) Light & Power Company, is developing an invention of his consisting of an electric illuminating sign to be attached to an incandescent or arc lamp post on business streets for advertising purposes.

Clarence G. Pyle, district sales agent, Standard Underground Cable Company, Los Angeles; **Julian Adams**, assistant electrical superintendent, Pacific Electric Railway Company, Los Angeles, and **M. G. Adler**, chief draftsman, Los Angeles Aqueduct Power, Los Angeles, Cal., have been transferred to the grade of Member A. I. E. E.

J. L. White, for several years manager of the Dallas division of the Oregon Power Company, has been transferred to Albany, Oregon, as manager of the company's interests there, succeeding **H. E. Morton**, resigned. **A. L. Martin**, formerly manager of the company's property at Corvallis will succeed Mr. White at Dallas, and **R. U. Steelquist** has been appointed manager in Mr. White's place at Corvallis.

Ralph B. Clapp has opened offices at 600 Fernando Building, Los Angeles, Cal., as manufacturers' agent and announces having secured, among others, agencies for the Hubbell line and for American Circular Loom in Southern California. This announcement will serve to correct a wrong impression created by part of our notice of last week regarding Mr. Clapp's association with F. Foster & Company, Los Angeles.

Geo. A. Hughes, president of the Hughes Electric Heating Company, accompanied by **W. L. Overman**, their western representative, were in Salt Lake City last week opening up the electric range business for their company, the Western Electric Company having arranged to carry a stock of their stoves. Mr. Hughes is enthusiastic over the prospects for electric heating particularly in western states, where so many electric companies have established special heating and cooking rates, which places the cost of cooking with electricity on a par with gas.

Stephen L. Coles has resigned the secretary-treasurership of The Society for Electrical Development, effective April 15. As of the same date he has joined the engineering staff of M. W. Thompson, 111 Broadway, New York City, specialist in litigated engineering matters and in reports on railroad and other large properties. Mr. Coles will devote his attention principally to electrical public utilities having problems of service, policy and competition to solve. He has grown up with the electrical industry, his first work having been with the old New England Wiring & Construction Company, of Boston, in installing an isolated electric lighting plant at Springfield, Mass., in 1889, for the Boston & Albany Railroad. Since August 1 last Mr. Coles has been acting secretary-treasurer and secretary-treasurer of The Society for Electrical Development and has concentrated his energies on doing his share toward making the Society an accomplished fact and an actual reality.

Leslie W. Allen, sales engineer, Westinghouse Electric and Manufacturing Company, Spokane, Wash., has been elected an associate member of the American Institute of Electrical Engineers. Other western engineers recently elected associates are: **G. B. Burnham**, sales agent General Electric Company, San Francisco; **E. C. Carr**, University of Washington, Seattle, Wash.; **Fred W. Dietrich**, assistant engineer, Eugene Water Board, Eugene, Ore.; **Walter H. Dyer**, instructor of electrical engineering, Billings Polytechnic Institute, Billings, Mont.; **G. E. Garthorne**, Pacific Gas & Electric Company, San Francisco; **James Oliver Jensen**, secretary and general manager Los Gatos Telephone Company, Los Gatos, Cal.; **Fletcher A. Jeter**, superintendent substations, Spokane Inland Empire Railway Company, Spokane, Wash.; **Paul P. Kaylor**, chief electrician Olympic Portland Cement Company, Bellingham, Wash.; **Chas. D. Kunkel**, sales engineer Westinghouse Electric & Manufacturing Company, Spokane, Wash.; **James N. Lightbody**, electrical draftsman, City Electric Light Department, Calgary, Alta.; **G. M. Simonson**, electrical draftsman, State Department of Engineering, Sacramento, Cal.; and **Merris Wenk**, draftsman, Stockton Iron Works, Stockton, Cal.

MEETING NOTICES.

Oregon Electrical Contractors' Association.

A regular business meeting of the O. E. C. A. was held Wednesday evening April 8th, at the Portland Commercial Club. In a short time the association expects to have the program for the coming convention prepared.

Seattle Jovian League.

The Seattle Jovians held their weekly meeting at the Hotel Lincoln Friday, April 10th. The after-dinner speaker was P. D. Naugle, engineer for the Kilbourne & Clark Company of Seattle, who spoke for about half an hour on the interesting subject of wireless telegraphy.

Portland Chapter, A. I. C. E.

Saturday evening, April 4th, the Portland Chapter of A. I. C. E. held their regular meeting in Portland, Oregon, when J. P. Newell presented a paper on "Depreciation as Applied in the Valuation of Public Utilities." Mr. Newell is one of the engineers connected with the railroad commission of Oregon. His interesting paper is to be published in the proceedings of the American Institute of Civil Engineers.

Utah Electric Club.

At the regular weekly luncheon of the Utah Electric Club held at the Commercial Club Thursday, April 9th, H. F. Holland, G. H. Williams and C. B. Hawley were appointed a joint committee of the Utah Electric Club to draft resolutions on the death of Vincent F. Connolly, who died suddenly at Idaho Falls on the 27th of March. Dr. C. A. Wherry, the regular speaker of the day, talked on the subject of "Radium and its Medical Application."

Portland Sections A. I. E. E. and N. E. L. A.

A joint meeting was held at 8 p. m. Tuesday, April 7th, at the Assembly Hall, Hawthorne Building, Portland, Oregon. An illustrated lecture "The Panama Canal and Its Electrification," prepared by D. B. Rushmore, was presented by E. A. West, efficiency engineer, Portland Railway, Light & Power Company. An interesting paper, now being published in this journal and entitled "Is Underwriters' Inspection Necessary in Oregon?" was presented by F. D. Weber, Inspector Underwriters' Equitable Rating Bureau.

Southern California Jovian Electrical League.

Frederick P. Vose, the well known Chicago attorney and secretary of the National Credit Men's Association, delivered a very instructive and gingery address before the League Wednesday, April 8th, on the subject of "Electrical Credits." What Mr. Vose does not know about the credit game is hardly worth knowing and a lot of valuable information was absorbed by all present. He deplored the lack of harmony and co-operation between the credit and sales department of the average business house, which he thought deserved very serious consideration. He classed Capital, Capacity and Character as the three most important things to be considered in extending credit, with Character as the most important of the three. Roland Paul sang and J. E. McDonald acted as chairman. The meeting being held at Christopher's, Los Angeles. A pool tournament in which the majority of the members will participate, will begin Wednesday, April 8th, and a theatre party is arranged for April 16th. A local employment bureau has been established for the benefit of the members.

Portland (Ore.) Ad Club.

In an atmosphere that was filled with the uncanny crackling and flashing of electricity, Lucifer himself appeared at the luncheon of the Portland Ad Club held at the Portland Hotel on April 8th, and thrilled the members with various startling feats, as he played with the tricky element. Preparations for the entertainment were elaborate. The installation of the lights and apparatus was by men from the Portland Railway, Light & Power Company, the Northwestern Electric, General Electric, Pacific States Electric companies and Contractors' Electrical Association. When the luncheon commenced a wireless machine crackled out an aerogram of greeting purporting to come from Thomas A. Edison.

When the announcement of the speaker of the day came, a quarrel was "faked" between President Berg and Vice-President Baker over the appointment of the day's chairman. Following a selection by the band of the Electrical Contractors, Mr. McMicken gave a talk on the development of the electrical industry. Then the lights flashed off, half a dozen electrical machines began sparking and sputtering and in the uproar L. T. Merwin, in the garb of Lucifer walked in and took charge of things. He was assisted by Philip Alger, disguised as a negro. They fried eggs by electricity on the cold top of a table, they welded iron bars in a basin of cold water, and performed half a dozen other startling feats. Then the negro was struck down by a fake contact and the pulmotor was rushed in.

At the later part of the program the "famous French savant, Henri Jacques Boissant," demonstrated his wonderful invention of the talking arc light. The arc light, tuned to respond to the vibrations of the human voice, delivered an address in French from where it hung above the heads of the Admen, while C. Henri Labbe translated for them. It transpired that Mr. Boissant was Folger Johnson and that the "talking arc light" was an electrical phenomenon, developed by men in the shops of the Northwestern Electric Company.

Thomas Drier, editor of Associated Advertising, talked on the demands of modern advertising.

San Francisco Jovians.

The San Francisco Jovians held their regular monthly meeting Tuesday of this week during the lunch hour, at a down-town cafe. The gathering was one of the largest and most enthusiastic held for some time, some sixty or more members sitting down to luncheon.

Having in mind the recent bereavement of Jovian H. B. Squires, the following resolution was read by A. H. Halloran, and adopted by the meeting:

"In view of the recent bereavement of H. B. Squires, and because of the high esteem in which his wife and helpmate was held by all who came in contact with her beautiful character and uplifting influence, and seeing that the world was better and brighter, life's struggle more hopeful, from her brief stay on earth,

"Be it Resolved, That the Jovian Order, through its local organization, tender its heartfelt sympathy and sincere condolence to our brother Jovian, and hereby express its deep sense of loss in the passing of this noble woman, whose high ideals, happy disposition and unselfish devotion should prove an example and inspiration to all;

"Be it further Resolved, That copies of this resolution be transmitted to the family and to the National headquarters and that a copy be preserved in the local archives of the Order."

A floral piece was ordered sent and a copy of the foregoing resolution was forwarded to Jovian Squires.

Report of the nominating committee, appointed at the previous meeting to select candidates for the degree team, and adopted as a whole, was as follows:

C. C. Hillis, Jupiter.	Jas. W. Redpath, Mercury.
M. S. Orrick, Neptune.	C. F. Butte, Apollo.
F. D. Fagan, Pluto.	W. S. Hanbridge, Hercules.
A. V. Thompson, Vulcan.	W. S. Dunbar, Avrenim.
A. H. Elliott, Mars.	P. B. Hyde, Triton.

Imps—H. A. Sayles, J. A. Herr, A. V. Olson, H. S. Wolfe, A. Kempston, W. L. Neelands.

Statesman Rowe announced that a rejuvenation would be held on Friday night, May 15, and appointed the following committees to start a campaign for members in each of the branches of the industry represented:

Manufacturers.	Jobbers.	Contractors.
P. B. Hyde.	A. Meinema.	W. S. Handbridge.
Thomas Collins.	M. Orrick.	C. F. Butte.
H. G. Aylesworth.	G. Curtis.	L. Levy.
Frank Fagan.	B. Y. Gibson.	N. M. Hope.
Central Stations.	**Street Railway.**	**Telephone.**
W. J. Neiman.	H. R. Noack.	W. S. Berry.
J. E. Van Housear.	A. V. Thompson.	John Gilkyson.
L. M. Hardie.	Carl Hiese,	H. C. Goldrick.
R. E. Fisher.	W. W. Briggs.	Garnett Young.

Prizes are to be awarded to those getting the greatest number of candidates, and considerable emulation will be developed in determining which branch will make the best showing.

An entertainment committee was also appointed, consisting of S. L. Hawkins, Arthur Brown, F. W. Wilson and D. G. Gallivan.

GAME WILL BE PLAYED.

The postponed ball game, Peddlers v. Pawnbrokers, will be played at San Francisco on the Ocean Shore Grounds, Saturday, April 18th, at 2:30 p.m. sharp. The date previously adveritised was in error.

CALIFORNIA ASSOCIATION OF ELECTRICAL INSPECTORS

Section of N. A. E. I.

C. W. Mitchell, President. Arthur Kempston.
Wm. G. Pennycook, Vice-Pres. B. C. Hill, Executive Comm.
John W. Carrell Secretary-Treasurer, 55 Fulton, San Francisco.

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correllate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

By the Secretary.

Majorities cannot make anything right but they sometimes decide questions. Men engaged in study along technical lines usually bow to the most highly developed opinion (if clearly set forth) even though it appear at first as a minority opinion.

Contractors, always engaged to some degree in keen competition, subject rules and opinions governing construction to severe egotistical calculation, because, among other things, they must make their business pay. Minimum requirements are usually maximum requirements for them. More than this they demand immediate decisions on questions which arise on the work and look at the decisions from the view-point of cost. For these reasons many arbitrarily assumed rules are established which vary according to the source of interpretation.

To promote uniform enforcement of the rules which comprise the National Code is the object of this association. Those who would aid in this work should send us questions on electrical construction met with in practice.

Ques. 1. Twenty-three motors operate tools in a machine and pattern shop and are supplied through cut-out cabinets as follows:

Cabinet No. 1—
72 In. planer .....30 h.p.
48 in. planer .....20 h.p.
60 in. lathe .....20 h.p.
30 in. lathe .....10 h.p.
18 In. lathe ..... 6 h.p.
Grinder ..... 3 h.p.

Cabinet No. 2—
8 ft. radial drill....10 h.p.
3 ft. radial drill.... 4 h.p.
60 ft. Boring Mill..15 h.p.
Slotter .....10 h.p.
Slotter ..... 3 h..p
Drill press ..... 5 h.p.

Cabinet No. 3—
Electric Crane:
Hoist .....20 h.p.
Bridge .....10 h.p.
Trolley ..... 3 h.p.
Hydraulic press ... 3 h.p.
Bolt cutter ..... 5 h.p.
(Note: Rubber covered wire.)

Cabinet No. 4—
Edger .....5 h.p.
Rip saw .....5 h.p.
Band saw .....7.5 h.p.
Joiner .....5 h.p.
Sander .....1 h.p.
Wood planer .....8 h.p.

Direct current is transmitted over a 2-wire service to a power panel and thence over separate feeders to the respective cabinets. What size wires are required for the service? For the feeders? What Code rules govern size of same?

Ans. 1. The aggregate current ratings of the motors plus 25 per cent of current rating of the largest motor in each of the respective cases would, of course, be the maximum current. Conductors having a safe carrying capacity equal to the maximum current would be accepted without question. The rules governing feed wires and sub feed wires is 23 (e). In my opinion Rule 8 (b) applies only to the actual leads or branch circuit to which the individual motor is connected and not to the feed.

The writer knows of an installation of small motors totaling about 150 h.p. For these a service of 2-700,000 c.m. was run, the motors operating at 250 volts. The service company placed two 300 amp. fuses ahead of the meter through which all current passed. I changed these fuses to satisfy myself that they were not reinforced with the time honored copper wire. To my knowledge the 300 amp. fuses held up for more than a year

For groups 1, 2 and 4 I should say that the feed wires have safe carrying capacity equal to 50 per cent of total current ratings of respective groups. For group No. 3, full capacity. For service, 35 per cent of total current ratings for all motors.

Ans. 2. Rule 8 (b). Full capacity and twenty-five per-centum of largest motor current.

Ans. 3. Replying to question No. 1, if you will refer to the Code Rule—Section 8 b—in the latter part of that section you will see that it is taken care of. In this case I would allow the main feeds and sub-feeds to be used large enough to take care of the maximum load without 25 per cent overload.

Ans. 4. Code Rule No. 8 (b) requires motor leads and branch circuits to be large enough to carry a current 25 per cent greater than that for which the motor is rated. Where several motors are on one set of feeders, as in this case, it is customary to make these feeders large enough to carry the full load current of all the motors plus 25 per cent of the full load current of the largest motor in the group. According to this rule the sizes of rubber covered wires required in this case would be as follows:

Cabinet No. 1—500,000 c.m.; No. 2—0000 B. & S. G.; No. 3—000 B. & S. G; and No. 4—00 B. & S. G. Service—1,400,000 c. m.

Note—Voltage not given in question. Taken to be 220 volts.

Ans. 5. Answering question one, you do not state what voltage is used, or the distance from the source of supply to the switchboard, or the distance from the switchboard to the different cut out boxes. Therefore I am assuming that the service is 200 ft. distant, that box No. 1 is 80 ft. from the switchboard; No. 2 is 75 ft.; No. 3 is 100 ft., and No. 4 is 85 ft., respectively. Also that the voltage is 500 and that the motors from 7.5 to 30 h. p. have an efficiency of 90 per cent, the 6 h.p. at 85; the 3, 4 and 5 h.p., 80, and the one h.p., 75 per cent. Further, that the drop in line voltage is two volts. Again the code rules, Section 8b, paragraph 3, provides that the branch circuits must be 25 per cent larger than the rated capacity of the motors.

This would make the size of wire necessary for service 500,000 circular mils. Circuit to cabinet No. 1 will require a conductor of 000; circuit to cabinet No. 2 will require a conductor of No. 1; circuit to cabinet No. 3 will require a conductor of No. 1; and circuit to cabinet No. 4 will require a conductor of No. 3.

Code rules, 8b, paragraph 3, and Section 18, govern the size of wires to be used.

Ans. 6. Problem No. 1—(1) Service for 125 volts would be 2-900,000 c. m., equivalent for each leg; (2) Feeders, cabinet No. 1, 800,000 c.m.; No. 2, 300,000 c.m.; No. 3, 300,000 c.m.; No. 4, 0000 c.m.

Ans. 7. There is no National Code Rule which fully covers the size of feeds for more than one d.c. motor on one set of feeds. The first three lines in the third paragraph of Rule 8 (b) Code comes the nearest to governing same. A d.c. motor starts through a rheostat made for the same size motor it controls and taking it for granted that each motor circuit to each individual motor from of the four cabinets complies with the third paragraph of Rule 8 (b) and that the circuits are each protected by their proper fuses and that the motors are the proper size motors for the machines they drive. I would consider that in figuring the size of feeds to each cabinet that if you allowed 25 per cent overload for the largest motor fed out of each cabinet and figure the other motors at their capacity and for the service if you allowed 25 per cent overload for the largest motor in the system (which is a 30 h.p motor) and all the other motors of the system at their capacity, I think you would have sufficient copper to comply with Rule 8 (b). The classification of service part of this rule does not apply to d.c. motors in my opinion. Taking this for granted, a 220 volt d.c. system and

figuring roughly, allowing 3½ amp. per h.p. and not considering the efficiency of the different motors which vary according to size, I would say the size of feeds were as follows: Cabinet No. 1, 335 amp., 2-500,000 c.m.; Cabinet No. 2, 185 amp., 2-0000 c.m.; Cabinet No. 3, 230 amp., 2-300,000 c.m.; Cabinet No. 4, 115 amp., 2-No. 0; and service, 900 amp., 2-1,700,000 c.m.

Ques. 2. A main service cut-out, enclosed in a metal cabinet, is installed in an unfinished attic at the point where the service enters the building. The attic is 8 ft. in height at the point mentioned and of easy approach by means of a stairway. Is this permissible?

Ans. 1. Yes.

Ans. 2. Yes, if an approved cabinet is used.

Ans. 3. Yes, refer to Section 23 (a).

Ans. 4. Yes, if the cabinet is an approved type. (Not in San Francisco, however, under the provisions of ordinance No. 2582.)

Ans. 6. I believe that the code permits the use of cabinet placed in an unfinished attic inasmuch as it does not mention this, but I believe that local conditions would govern this kind of installation for in some cities the meter must be in a certain place on the outside of a building; in this instance the service would have to be run through to the ground again, then up to the top floors. I would not allow this only in special cases.

Ans. 5. No. Not accessible according to code.

Ans. 7. I would say yes on this particular building (Rule 23a). But on most buildings in this city it would be impractical and cut-outs would not be readily accessible on account of not having attics of that size and most of them none at all.

Ques. 3. How far should a cross-over tube extend on each side of a passing conductor?

Ans. 1. Far enough to give the required distance between wires for the parts of the wires not covered by the tube.

Ans. 2. I should say two inches.

Ans. 3. A cross over tube should not be less than three inches and the wire crossing same should be in the center of tube and fastened to the tube with tape and painted.

Ans. 4. Bushing should extend two inches on each side of wire as covered by Section 16 (e).

Ans. 5. Rule 26 (R) while not directly applicable will require tubes to extend one inch beyond the passing conductor.

Ans. 6. I would say a three inch tube or an inch and a half on each side of a passing conductor if tube is securely fastened to the wire at both ends. Rule 16 (e) does not state length of tube.

Ans. 7. Must be kept two inches from passing conductor or enclosed so as to maintain a two inch separation. See Rule 16 (e).

UNITED STATES CIVIL SERVICE EXAMINATION FOR ELECTRICIAN.

The United States Civil Service Commission announces an open competitive examination for electrician, on May 6, 1914. From the register of eligibles resulting from this examination certification will be made to fill vacancies as they may occur in this position in the Departmental Service at Washington, D. C., and other services, unless it is found to be in the interest of the service to fill any vacancy by reinstatement, transfer, or promotion. The usual entrance salary for electricians is about $4 per diem.

Competitors will be examined in:

Subject.	Relative Weight.
1. Report writing (test in writing in letter form a report not more than 200 words in length, summarizing and arranging in logical order a series of facts included in a given statement of 400 or 500 words)	10
2. Practical questions	65
3. Training and experience	25
Total	100

Experience in the care, maintenance, repair and operation of station storage batteries and lead burning is very desirable in this examination, and persons with such qualifications should state fully their experience in the application. Age, 20 years or over on the date of the examination. This examination is open to all men who are citizens of the United States and who meet the requirements. Persons who meet the requirements and desire this examination should at once apply for application Form 304 to the United States Civil Service Commission, Washington, D. C., or to the secretary of the United States Civil Service Board at any of the principal cities of the United States.

UNITED STATES CIVIL SERVICE EXAMINATION FOR ELECTRICAL MACHINIST.

The United States Civil Service Commission announces an open competitive examination for electrical machinist. From the register of eligibles resulting from this examination certification will be made to fill one vacancy in this position in the Signal Service at Large, Fort Wood, New York, and one in the same service at Fort Mason, California, each at $1000 per annum, and vacancies as they may occur in positions requiring similar qualifications, unless it is found to be in the interest of the service to fill any vacancy by reinstatement, transfer, or promotion.

Competitors will not be assembled for examination, but will be rated on the following subjects:

Subjects.	Relative Weight.
1. Physical ability	40
2. Training and experience	60
Total	100

Applicants for this position should be practical electrical machinists with three years' or more experience and it is absolutely essential for an applicant to have the following qualifications:

(a) He must be an electrical machinist or instrument maker.

(b) He must have a common knowledge of electricity as to circuits, insulation, conductivity, and contacts, in order that he may be able to handle electrical apparatus and instruments in an intelligent manner.

(c) He must be competent to repair telephones, telegraph instruments, switchboards, radio apparatus, etc., which includes the making of parts of such instruments, and repairing and making tools. Age, 20 years or over on the date of the examination.

This examination is open to all men who are citizens of the United States and who meet the requirements. They should at once apply for application Form 1800 to the United States Civil Service Commission, Washington, D. C.; the secretary of the United States Civil Service Board, Post Office, Seattle, Wash.; or San Francisco, Cal. No application will be accepted unless properly executed, including the medical certificate, and filed with the commission at Washington prior to the hour of closing business on April 27, 1914.

INDUSTRIAL GAS CALORIMETRY.

Those of our readers interested in the measurement of the heating valnes of gases will be pleased to hear of a forthcoming publication, from the Bureau of Standards, of a paper entitled Industrial Gas Calorimetry, dealing with this question in great detail. The accurate measurement of the heating value of gases is a question of great importance at this time to all interested in gas, whether from the manufacturing, inspecting, or regulating aspects, so that an authoritative publication dealing with this important question will no doubt prove of interest and value to many American engineers and technical men. Reprints of this paper, which contains over 125 pages and 70 tables and illustrations, may be obtained from the Bureau of Standards, Washington, D. C., on written request. It will come from press about June 1st.

INDUSTRIAL

A "SAFETY FIRST" WASHING MACHINE.

The illustration herewith gives a good idea of the main features of one of the popular electric washing machines now on the market. To those familiar with machines of this character, the main features of the Eden will especially appeal. It will be noticed that all gearing and moving parts are covered, avoiding all chance of injury to the person of



Dissembled View of "Eden" Washer.

the operator or to children, even the shaft from the motor being covered. All of the gearing or parts requiring lubrication run in a tight box filled with hard grease, thus doing away with the necessity of oiling, and insuring cleanliness. The body and frame of the machine is heavily enameled in gray. It has other novel features. These machines will be handled by the Electric Appliance Company, 807 Mission street, San Francisco.

ELECTRIC CURLING IRON.

A new electric curling iron is being manufactured and sold by the Westinghouse Electric & Manufacturing Company. This curling iron can be used with stored heat, as with the flame-heated curling iron. In addition, it can be used with continuous heat, a use which cannot be obtained with the flame-heated iron.

For use with stored heat, the iron is first heated by connecting it to the electric circuit. When it is hot, the swivel plug is pulled out, disconnecting the cord and electric circuit. It is then like the flame-heated curling iron and is used in the same manner. When it gets cold, the plug is pushed into place until it is hot again.

When it is used with continuous heat, the swivel plug enables the user to grasp the iron in such a way that it can be freely rotated by the thumb and fingers without twisting the cord.

It can be used with or without the hair clamp, which is easily removable.

This iron is the result of long study and experimentation, a curling iron that is simple, reliable and very rugged in construction. The heating element is in the form of a rod inserted directly in the barrel. It can be removed by loosening two screws in the handle. If from misuse, the heating element burns out it can be replaced with less than five minutes work. The heating element terminals are positive in action, there being no possibility of loose contacts. The swivel plug, which fits in the end of the handle, is formed of especially prepared moulded composition and will not break if dropped. In this plug are carried strong spring contacts which make connection with the terminals of the heater. The cord is attached to these contacts within the swivel plug. There are no exposed terminals and hence no live parts.

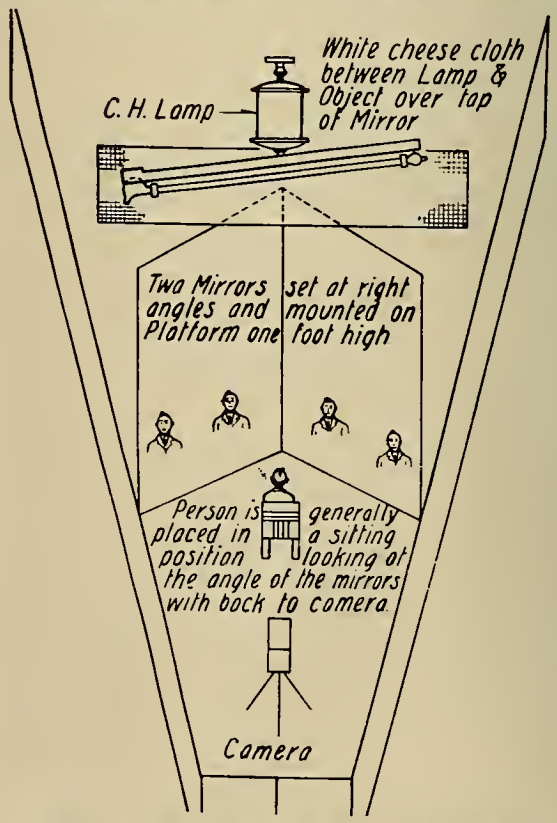
As the input is only 15 watts, it costs only about one-tenth of a cent an hour to use this curling iron with the average price for current.

All metal parts are nickel plated and highly polished. The handle is of wood, black ebony finished and highly polished.

MULTIPLE PHOTOGRAPHS.

The scheme of showing in a photograph four or five likenesses of one individual has always proved an attractive one because of a certain air of mystery surrounding it. To the average person it is quite mystifying how the different poses can be secured of the same individual all on one plate. The attached sketch shows how this may be effected.

There are two special mirrors with frames only on three sides each five feet high and three feet wide placed at angles of about 75 degrees to each other, the angle being formed



Arrangement of Equipment for Multiple Photography.

by the edges of the glass alone. The subject sits at a table with his back to the camera, facing the angle formed by the mirrors. The camera then points at the back of his head, and the reproduction obtained from the combination of the mirrors results in showing on the plate a reproduction which

looks as if five men were sitting at the table, each an exact duplicate of the other.

Frequently, the subject is photographed playing cards, and this results in a view of five men, exactly the same in appearance, playing a game of cards with each other.

Not the least important feature of this scheme is that of securing the right light with the proper diffusion. In this case, the well known Cooper Hewitt lamp is suspended directly over the man's head, and about half way between the location of the man and the mirrors. White cheese cloth is placed between the lamp and the object over the top of the mirrors in order to further increase the diffusion.

The accompanying illustration shows how the scheme may be worked out.

TRADE NOTES.

A. J. Pahl, K. P. F. Electric Company, San Francisco, has the contract for laying the new submarine cable under San Francisco Bay for the Great Western Power Company.

The American Ever-Ready Company, New York City, manufacturers of batteries, electric flash lamps, etc., is now to be known as American Every Ready Works of National Carbon Company.

Wagner Electric Manufacturing Company of Saint Louis, announce the opening of a branch office in Suite 524, Syracuse University Block, Syracuse, New York, in charge of J. W. Bryant, resident agent.

The Union Iron Works, which recently moved into its new headquarters and works at Fifty-second street and Santa Fe avenue, Los Angeles, Cal., is making arrangements through Wm. van den Heuvel, consulting engineer, for the purchase of the necessary apparatus for the furnishing of direct current energy for part of its new shop equipment.

The Cutler-Hammer Manufacturing Company has recently taken over the Vulcan Motor Devices Company, of Philadelphia, makers of the Vulcan Electric Gear Shift. This gear shift will be manufactured and marketed exclusively by The Cutler-Hammer Manufacturing Company at the Milwaukee plant under the Vulcan patents.

The Shaw Mining & Milling Company intend building a 2200 volt transmission line 1½ miles in length from the Western States Gas & Electric Company's line 1½ miles to their mine near El Dorado, California. H. de C. Richards, Crocker Building, San Francisco, is manager. The installation will include an electric hoist, air compressor, lighting equipment and mill motors.

Thirty-two 25 h.p., 440 volt, 3 phase, 25 cycle, 750 r.p.m. squirrel cage induction motors have just been shipped to the Duluth, Messabe & Northern Ry. Company of Duluth, Minn., by the Ideal Electric & Mfg. Company. The road is a subsidiary of the U. S. Steel Corporation. These motors are for the equipment of the new No. 5 iron ore docks which are reported to be the largest iron ore docks in the world. Each motor will operate a bank of 24 chutes.

The Asbestos Protected Metal Company of Beaver Falls, Pa., is marketing a new form of prepared roofing which they have named Aegisroll, the body or base of which is wool felt impregnated by waterproofing and completely enveloped in a coating of asphalt compound. To the upper surface is attached pure asbestos felt, while the lower surface is protected by a coating of crushed quartz. Both the asbestos and the crushed quartz are embedded into their respective surfaces while the asphalt is hot and are therefore permanently attached. Due to the advancements made by the Asbestos Protected Metal Company in permanently coloring asbestos felt, Aegisroll Roofing can be furnished in a variety of attractive colors, making possible for the first time, artistic combinations between roofs and the color treatment of the building. Booklet and samples sent on request.

SPECIAL TRAIN TO N. E. L. A. CONVENTION FROM PACIFIC COAST.

Plans are now being formulated to send a special train to the thirty-seventh convention of the National Electric Light Association from the Pacific Coast. The convention will be held at Philadelphia, June 1, 2, 3, 4 and 5, 1914. As there is a strong probability that next year's convention can be brought to San Francisco during the Exposition, it is especially desirable that a large and enthusiastic Western delegation attend the Philadelphia convention.

It is hoped to make up a special train consisting of cars from Seattle and Portland, Los Angeles, Salt Lake City and Denver, to join a big delegation leaving San Francisco on May 26. As trains to the N. E. L. A. conventions have always been famous for their fine service and lavish entertainment, this offers an excellent opportunity for any friends of electrical men to have an enjoyable trip East, if they contemplate going about this time. Interested parties can communicate with Mr. E. B. Strong, Pacific Coast master of transportation, at the office of this journal.

BOOK REVIEWS.

National Association of Railway Commissioners—Being the Proceedings of the Twenty-fifth Annual Convention of the Association held at Washington, D. C.; 612 pp.; 6x9 in.; cloth bound. Published by the Law Reporting Company, and for sale by Technical Book Shop, Rialto Building, San Francisco, Cal. Price $1.

This volume should prove an invaluable aid to public utility officials and to others interested in commission control, its attitude, effects, and possibilities. The work of the railway commission is so generally associated with public utilities in general that this report could very satisfactorily and justifiably have been published under a broader title.

Switchgear and the Control of Electric Light and Power Circuits. By A. G. Collis, A. M. I. E. E.; 85 pp.; 4x6½ in.; cloth bound. Published by D. Van Nostrand Company, and for sale by the Technical Book Shop, San Francisco Price 50 cents.

This is the latest addition to a series of Electrical Installation Manuals, nine others on different subjects having been published. This manual deals in elementary terms with the results of practical experience gained during the author's association with switchgear design. Mathematical treatment has been avoided and the subject so dealt with that it is readily understandable. A number of diagrams facilitate this end.

An Elementary Manual of the Steam Engine. By E. C. Lallier; 266 pages; 5½x8 in.; cloth bound. Published by D. Van Nostrand Company, New York City, and for sale by Technical Book Shop, San Francisco. Price, $2.

This text is a practical description of how and why the steam engine works. It begins with a chapter on reciprocating engines, followed by those on governors, engine calculation and the indicator. Then follows treatment of boilers, pumps and Cornish engines. The finishing chapters are devoted to pipes and fittings, rotary engines, internal combustion engines and lubrication. The text and illustrations are clear, so that the average operating man can grasp the fundamental principles of the machinery with which he is in daily contact.

Elementary Magnetism and Electricity. By Cyril M. Jansky, B. S., B. A., associate professor of electrical engineering, University of Wisconsin; 212 pp.; size 6x9 in.; fully illustrated; cloth bound. Published by the McGraw-Hill Book Company, and for sale by the Technical Book Shop, Rialto Bldg., San Francisco. Price $1.50.

This book was prepared in the extension division of the University of Wisconsin. To make the principles real the subject is developed experimentally. This makes the book of especial value to those having practical experience with electrical apparatus, but whose knowledge of the principles of its operation, is limited as in this way it develops the how and why of the apparatus. It is probably the best work of its kind ever placed on the market and is not limited to any particular class of readers.

NEW CATALOGUES.

The P. & H. Excavator is described in a bulletin issued by Pawling & Harnischfeger Company, Milwaukee, Wis.

Bulletin 22-1914, now being distributed by the Century Electric Company, St. Louis, Mo., describes in detail the various styles and types of Century alternating current fans.

Benjamin Friction Drive Screwdrivers, with insulated handles, now constitute a complete line and are listed in a new catalogue being distributed by the Benjamin Electric & Manufacturing Company, Rialto Building, San Francisco.

The Electric Storage Battery Company, Philadelphia, Pa., has just issued Hand Book H X which deals with "Hyray-Exide" Battery and switchboard units, switches, ampere hour meters, and gives prices, terms and directions for ordering

Century, Single-Phase, Self-Starting Motors is the title of a comprehensive booklet (Bulletin 21, Jan., 1914), issued by the Century Electric Company, St. Louis, Mo. It describes fully this company's make of repulsion-induction type of motors.

Electric Fans are dealt with in catalogue 329 of the Sprague Electric Works of General Electric Company, New York. It gives considerable detailed information about this line. Portable Ozonators are described in bulletin 49,000 of the same company.

Electric Lights on Your Automobile is the title of an envelope stuffer being distributed by the Wagner Electric Manufacturing Company, St. Louis. It tells about the Wagner Rectifier for charging storage batteries and gives prices and full particulars.

A comprehensive treatise on Condensers and Auxiliaries, just off the press, is being distributed by the C. H. Wheeler Manufacturing Company, Philadelphia, Pa. It contains 132 pp. and is illustrated with many excellent half-tones and line drawings, which further explain the excellent information with which it is full.

The "Chicago Gatling" Drill (pneumatic) is dealt with in Bulletin No. 152 issued by Chicago Pneumatic Tool Company, Chicago, Ill. The "Chicago Stoper" rock drill is described in bulletin No. 154 of the same company, the No. 5 Chicago Plug & Feather Drill in Bulletin No. 172 and the "Chicago Sinker" for drilling deep holes of large diameter in No. 153.

New Lighting Units is the title of a new bulletin issued by the Holophane Works of General Electric Company, San Francisco. It is devoted to lighting glassware, reflectors, holder sockets and fixtures for use with the new 750 and 1000 watt Mazda (nitrogen filled) lamps. Incidentally, it shows the scientific manner in which these high power lamps should be installed.

Bulletin No. 57, "The Phenix Sight Flow Indicator," issued by The Richardson-Phenix Company of Milwaukee, Wis., describes how this unique device can be inserted in any pipe line carrying a liquid, such as water lines of water cooled transformers and the supply pipes of water jackets of gas engines and air compressors, and how it shows at a glance or indicates electrically by lighting a lamp or ringing a bell when the flow of liquid is interrupted. Several recent improvements in the Sight Flow Indicator are also described.

The General Electric Company recently issued Bulletin No. 45,501, describing that company's Aluminum Lightning Arresters for Alternating Current Circuits. The important features in electrolytic lightning arrester design and embodied first in G-E arresters dealt with. The bulletin consists of thirty-two pages, filled with detailed information relative to these arresters and choke coils for use with them, with notes on the charging operation, installation and ground connections. There are also diagrams and tables of dimensions of both arrester and choke coils. This bulletin supersedes the company's previous bulletin on this subject.

The Manual of Electrical Testing published by the Wagner Electric & Manufacturing Company, St. Louis, Mo., and now ready for distribution, fully justifies its name. It is Bulletin No. 104 of 1914, and contains a general statement of the underlying principles and conditions under which the degree of accuracy of indication and the permanency of calibration are effected in portable instruments. Nevertheless it describes the instruments in detail. The majority of the 48 pages are devoted to General Notes on Electrical Testing. Line drawings are given as an aid to interpreting the text. The booklet is well worth endeavoring to secure.

Bulletin No. A4200, issued by the General Electric Company, is devoted to Strain Insulators and Strain Clamps suitable for insulating and supporting power house wiring and overhead distributing cables and wires. The construction of these insulators and clamps is illustrated and described, and the bulletin contains also catalogue numbers and prices of the various articles. Bulletin No. 44590 supercedes the previous bulletin. The function of the Type ML governor described is to automatically control the operation of either stationary or railway motor driven air compressors in order to maintain air pressure in a storage reservoir between predetermined limits. Bulletin No. 47400 illustrates and describes the Type F, Form K12 Oil Switches. This supersedes a previous bulletin on this subject, and contains up-to-date information on this very important piece of electrical apparatus. Bulletin numbered 45,600 describes Aluminum Lightning Arresters for use in connection with railway signal circuits. It supersedes the General Electric Company's previous bulletin on the same subject.

PUBLICATIONS RECEIVED.

Electric Switches for Use in Gaseous Mines, by H. H. Clark and R. W. Crocker, is the title of Bulletin No. 68 issued by the Bureau of Mines, Washington, D. C.

Preliminary Report No. 2 on Petroleum, issued by the California State Mining Bureau, San Francisco, consists of Notes on Damage by Water in California Oil Fields.

The action of acid mine water on the insulation of electric conductors is dealt with in Technical paper 58 of the Bureau of Mines of the U. S. Government, Department of the Interior.

"The Sampling and Examination of Mine Gases and Natural Gas," from the Bureau of Mines, Washington, D. C., is a 116 pp. paper covered bulletin by George A. Burrell and Frank M. Seibert.

Analysis of Alternating Current Waves by the Method of Fourier, with special reference to methods of Facilitating the Computation, by Frederick Grover, published as Reprint No, 203 from Bulletin of the Bureau of Standards, Vol. 9, Washington, D. C.

Several lectures and papers of the Interstate Commerce & Railway Traffic Course prepared for non-resident instruction of students of the La Salle Extension University have been received. They comprise text books on the organization and operation of the Industrial Traffic department by W. N. Agnew; Statistics of Freight Traffic by Julius H. Parmelee, Ph. D., statistician, Bureau of Railway Economics; Bases of Freight Charges, by C. L. Lingo, and Freight Rates, Official Classification Territory and Eastern Canada by C. C. McCain, chairman, Trunk Line Association.

The report of the Joint Rubber Insulation Committee, recommending a well defined method of procedure in the analysis of rubber for insulation and other uses, has just been reprinted by the Simplex Wire & Cable Company, Boston, Mass. The full report of this committee provides a method of avoiding misunderstandings in connection with rubber analyses, and consists of twenty-four pages. As readers will recall, this report was prepared by a number of interests identified with this subject, including the United States Signal Service and Bureau of Standards, the American Chemical Society, two of the large trunk line railroads and four of the manufacturers of rubber-insulated wires.

NEWS NOTES

FINANCIAL.

SAN FRANCISCO, CAL.—Earnings of the Geary Street Municipal Street Railway during March reached a total of $58,969.50. This exceeds by $300 any previous month, the next biggest being October with $58,663.50. The Union street line reached a total of $29,715.10, which is more than half of the amount earned by the Geary street line, while it is not half the length of that road and did not cost one-sixth of the Geary street system. The total amount earned by the two roads during the month was $88,864.60.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company have filed a mortgage with the County Recorder of Utah county made in favor of the Guaranty Trust Company of New York and William C. Cox as trustee, covering the issue of $100,000,000 worth of 5 per cent first mortgage gold bonds. The mortgage covers every conceivable physical asset of the power company. The purpose of filing the mortgage is to provide for the issuance of the first issue of bonds amounting to $10,000,000, the sale of which has recently been effected by the company. Manager P. B. Sawyer announces that his company has recently negotiated the sale of this issue for the purpose of replacing the short time notes of the Utah Securities Company, which were used in effecting the consolidation of the various companies which the Utah Power & Light Company purchased in Utah, Idaho and Colorado. A part of the proceeds of this bond issue will be used for making contemplated extensions and improvements and for those now in progress. The remainder of the $100,000,000 bond issue will be used from time to time as the financial interests of the company require.

INCORPORATIONS.

SAN LUIS OBISPO, CAL.—Santa Maria Gas & Power Company, $1,000,000, shares $100 each, subscribed, $500, by P. O. Tietzen, T. B. Adam, J. F. Goodwin, J. E. Walker et al.

LOS ANGELES, CAL.—The Niland Water Company has been incorporated with capital of $150,000, by Arthur E. Hull, John R. Woodbridge, D. B. Lyons, E. M. Coplen and Col. R. W. Richardson. The company will begin immediate operations for the development of a water supply for the new town of Niland at the northern end of the Imperial Valley. Reservoirs and settling tanks will be established at once on outskirts of Niland.

SANTA BARBARA, CAL.—A $2,000,000 corporation to provide electric power and lighting facilities for the Santa Ynez Valley, the northern end of the county, and all of San Luis Obispo county, filed articles of incorporation here today, being the Midlands Counties Public Service Corporation. The principal place of business is in Los Angeles. The stock is equally divided between common and preferred, and controlling interest has been secured by the incorporators subscribing $1,000,500. Of this big amount William Kerckhoff and A. C. Balch subscribe $250,100 each; Kaspar Cohn, A. Haas, A. G. Wishon and A. E. Wishon subscribe $125,000 each. The company has acquired the power plants at Santa Maria, San Luis Obispo, Lompoc and other points, and plans for immediate extensions are being made. The new company is a subsidiary of the San Joaquin Light & Power Company. A. G. Wishon, one of the incorporators in the Midlands concern, is general manager of the San Joaquin company. Power will doubtless be supplied by the immense plants of the San Joaquin company in the Sierra mountains.

ILLUMINATION.

LAS VEGAS, N. M.—The town council of West Side has signed a contract with the Las Vegas Light & Power Company for additional street lights.

OAKLAND, CAL.—The county supervisors have granted the Pacific Gas and Electric Company a franchise to lay pipes for supplying gas to residents in Alameda county.

PASADENA, CAL.—The city commission has awarded the contract for installation of an ornamental lighting system on Colorado street from Los Robles avenue to the east city limits, to the Woodhill-Hulse Electrical Company of Los Angeles, for $18,500.

SANTA BARBARA, CAL.—W. A. Brackenridge, vice-president; S. M. Kennedy, secretary, and J. T. Huntington, manager of the Santa Barbara Electric Lighting & Gas Company, held a recent conference with leading ranchers and business men of Carpinteria valley with a view to putting the valley under an electric light and power system. The company proposes to expend $35,000 on the project.

SALT LAKE CITY, UTAH.—The Manufactures' Association of Utah recently installed a unique slogan sign. The sign was first used at the exhibition of Utah products held at Salt Lake City, April 2d to 9th. The sign represents a map of the state of Utah with its principal counties, lakes, rivers, mountains and cities painted on the background. The state border is outlined with incandescent lamps and the words, "I am for Utah" are displayed in raised letters on the face of the sign. The state emblem, a beehive, is also depicted in electric lamps. This sign will be erected permanently in front of the Chamber of Commerce Building, where the Manufacturers' Association maintains an exhibit of Utah products.

TRANSMISSION.

RIVERSIDE, CAL.—The board of supervisors of Riverside county has granted a franchise to the Coachella Valley Ice & Electric Company to construct and operate electric transmission lines over and across public roads and highways in the county.

TERRA BELLA, CAL.—The Mount Whitney Power & Electric Company will erect a substation a mile east of Terra Bella to take care of its increasing business here. The new station will be one of five similar stations to be built this spring, the other stations being at Earlimart, Goshen, Strathmore and Woodville.

SALT LAKE CITY, UTAH.—A canvass of all of the manufacturers exhibiting at the Utah products show given under the auspices of the Manufacturers' Association of Utah in the Keith Building of Salt Lake City, showed that of approximately one hundred manufacturers exhibiting, ninety-one per cent of them used electric power exclusively for the manufacture of their products, the largest user having a maximum load of 2500 kilowatts.

LOS ANGELES, CAL.—The safety commission created by the city council to take charge of the police telegraph and fire alarm system has organized by the election of Councilman John W. Snowden as president and R. H. Manahan, city electrician, as secretary. The other members of the commission are Chief of Police Sebastian and Fire Chief Eley. It was decided to request the budget committee of the council to set aside $250,000 for construction work during the coming year. The work will be done under the supervision of City Electrician Manahan.

TRANSPORTATION.

SACRAMENTO, CAL.—An ordinance requiring the Pacific Gas & Electric Company immediately to double-track the Tenth street line to the baseball grounds has been passed by the city commissioners.

STOCKTON, CAL.—John R. Humphries, G. McM. Ross and Amos Jones resigned their directorship in the Stockton Terminal & Eastern Railroad Company and the United Investment Company at the last meeting. Wm. Nichols Jr. of Berkeley, Chas. Prater of Stockton, and J. A. Stevenson of San Francisco were elected to fill the vacancies.

SAN FRANCISCO, CAL.—The engineering department of the United Railroads has begun work on the extension of its Polk and Larkin streets cross town line to North Point street, a distance of half a mile. The North Point terminus will enable patrons to reach the Van Ness avenue entrance to the Exposition with a walk of a short block.

PORTLAND, ORE.—Application for an interurban car franchise across the new Columbia River bridge and approaches has been made by Isaac W. Anderson, president of the Washington-Oregon Corporation, a Washington concern which operates a street car system in Vancouver and would extend its line to Portland when the bridge is completed.

PORTLAND, ORE.—Application for a 25 year franchise for a complete railway system covering practically the entire East Side and entering the West Side has been filed with Commissioner Daly of the department of public utilities by the Portland & Oregon City Railway, through Stephen Carver, a promoter, who is said to be representing Eastern interests.

FRESNO, CAL.—Following the filing of a petition by John B. Rogers, president of the Fresno Interurban Railway Company, the board of supervisors gave notice that on May 5th it would sell to the highest bidder a 50 year franchise for an electric railroad along the county road on Fresno avenue for a distance of a half mile, or, from the city corporate line to the boulevard.

OAKLAND, CAL.—The new electric train block "foolproof" system, installed by the Oakland, Antioch & Eastern Railway at a cost of $170,000 was given its initial work-out a few days ago. The system extends from Oakland to Sacramento. The system tells the approach of trains, the location of broken tracks, open switches or any possible unnatural condition of the roadway.

RICHMOND, CAL.—The San Francisco-Oakland Terminal Railways Company has made a lively start on its development program in Richmond. With hardly any preliminary announcement, it has begun unloading rails and ties for the double-tracking of its lines on Macdonald avenue and Twenty-third street. Contracts have been let for the work. This is the first important construction work undertaken by the street railway corporation since its refinancing.

SAN FRANCISCO, CAL.—Final action has been taken in the matter of the removal of street railway tracks in the civic center, being those tracks now operating on Polk street, Grove street and City Hall avenue. The United Railroads has agreed to the removal of these lines of traffic and the transferring of cars to Hayes, Larkin and McAllister streets. At the same time preliminary steps were taken to secure the removal of certain tracks in Stockton street to make way for the proposed municipal line in that street.

FRESNO, CAL.—Negotiations are under way between property owners southeast of Fresno and the Fresno Traction Company for the construction of an interurban line to Calwa, a distance of about three miles. A proposition from the property owners was presented to Paul Shoup some time ago. The route of this new interurban line has not yet been definitely determined, but it is asserted that it will leave the city from the Recreation Park line. The Calwa line will branch off the Recreation Park line near the car barns of the traction company.

OAKLAND, CAL.—Stockholders of the San Francisco-Oakland Terminal Railways have voted to increase the bonded indebtedness of the company from $20,000,000 to $35,000,000 subject to the approval of the State Railroad Commission, and to issue new securities to be known as "first and refunding 35 year 5 per cent gold bonds." Of the new issue $20,000,000 will be set aside for refunding the old bonded indebtedness. Part of the $15,000,000 remaining will be used "to acquire property within the purpose of the corporation and for the extension and improvement of its facilities and the improvement and maintenance of its service."

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has awarded to the Westinghouse company contracts for motor generator sets of an aggregate capacity of 6000 kw. to be delivered in San Francisco before July 15, and to be installed for the operation of the municipal street railway lines now under construction. The Pacific company is already supplying electric power to the Geary street line, which forms the nucleus of San Francisco's rapidly expanding network of street railways. This company is at the present time supplying the power for the operation of 639 miles of city and interurban electric railways, including the Southern Pacific Company's lines in and about San Jose, the Oakland Traction Company and the Northern Electric Railway Company.

TELEPHONE AND TELEGRAPH.

NEWPORT, CAL.—Bids will be received up to May 4th for a franchise to construct telephone and telegraph wires in this city.

HILO, T. H.—The telephone company is preparing to do some general repair work on its country lines and has ordered 1150 poles from the Hilo Mercantile Company.

LOS ANGELES, CAL.—The Los Angeles District Telegraph Company has been granted a franchise to construct and operate for a period not to exceed 21 years, a district messenger signal system in this city.

ESCONDIDO, CAL.—L. Montgomery, installer for the Pacific States Telephone & Telegraph Company, is arranging for the installation of additional equipment in the way of another toll line between Escondido and Vista, work is to begin at once.

GARDNERVILLE, NEV.—The residents of Diamond Valley have made arrangements with the Farmers' Telephone Company for connections and the lines are to be extended to that section in the near future. The residents of the valley have agreed to stand the cost of construction.

WATERWORKS.

PULLMAN, WASH.—The city council has instructed the city clerk to advertise for bids for pipes, fittings, pumps, etc., for the $25,000 improvements to the water system.

THREE FORKS, MONT.—The city council has called a special election for April 23, when the city will vote on issuing $45,000 worth of bonds for a municipal water system.

LEWISTOWN, MONT.—Bids will be received until May 11, for the purchase of $60,000 worth of water bonds of the city of Lewistown, for the purpose of reconstructing the water works system.

MONTAGUE, CAL.—The town trustees have awarded the contract for the installation of their municipal water system, with the exception of the pumping plant to C. D. Vincent of Oakland, for $20,700.

BOLINAS, Cal.—The powerful new wireless stations of the Marconi Company at Bolinas and Marshall bays are about completed, and within three weeks the local operators will be sending and receiving long distance messages. All that remains is the completion of the Honolulu station.

LEWISTOWN, MONT.—The election held to vote on the $90,000 water bond issue carried. The proceeds will be used in continuing the iron water works system up Spring creek. The city will advertise for bids for the bonds and it is expected that they will be sold in May, and the pipe laying will begin about May 20.

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BY GEO. J. HENRY.

POLICY OF PUBLIC SERVICE CORPORATIONS.

BY JOHN A. BRITTON.

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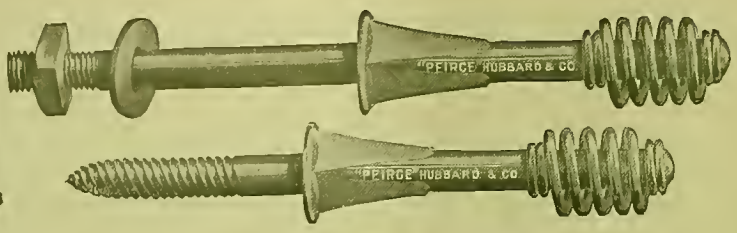
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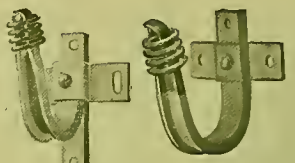
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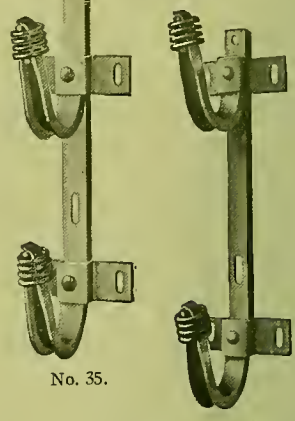
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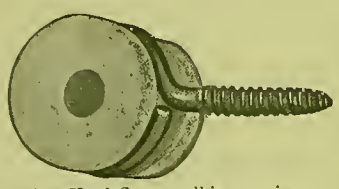


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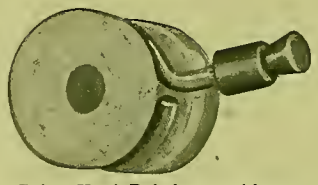
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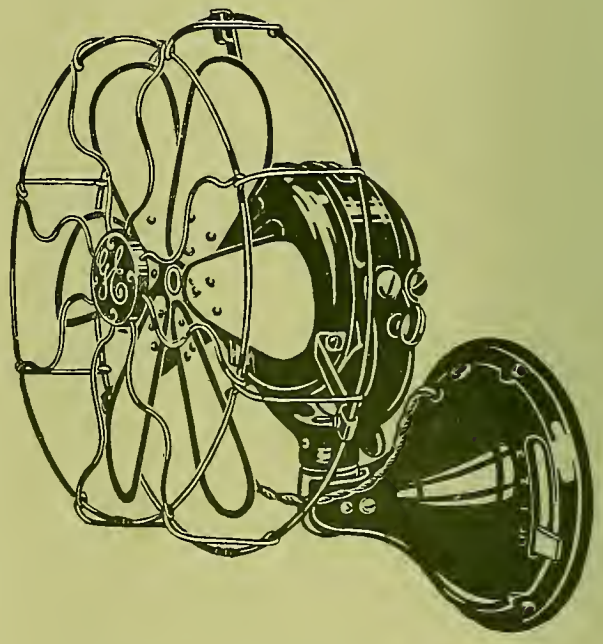


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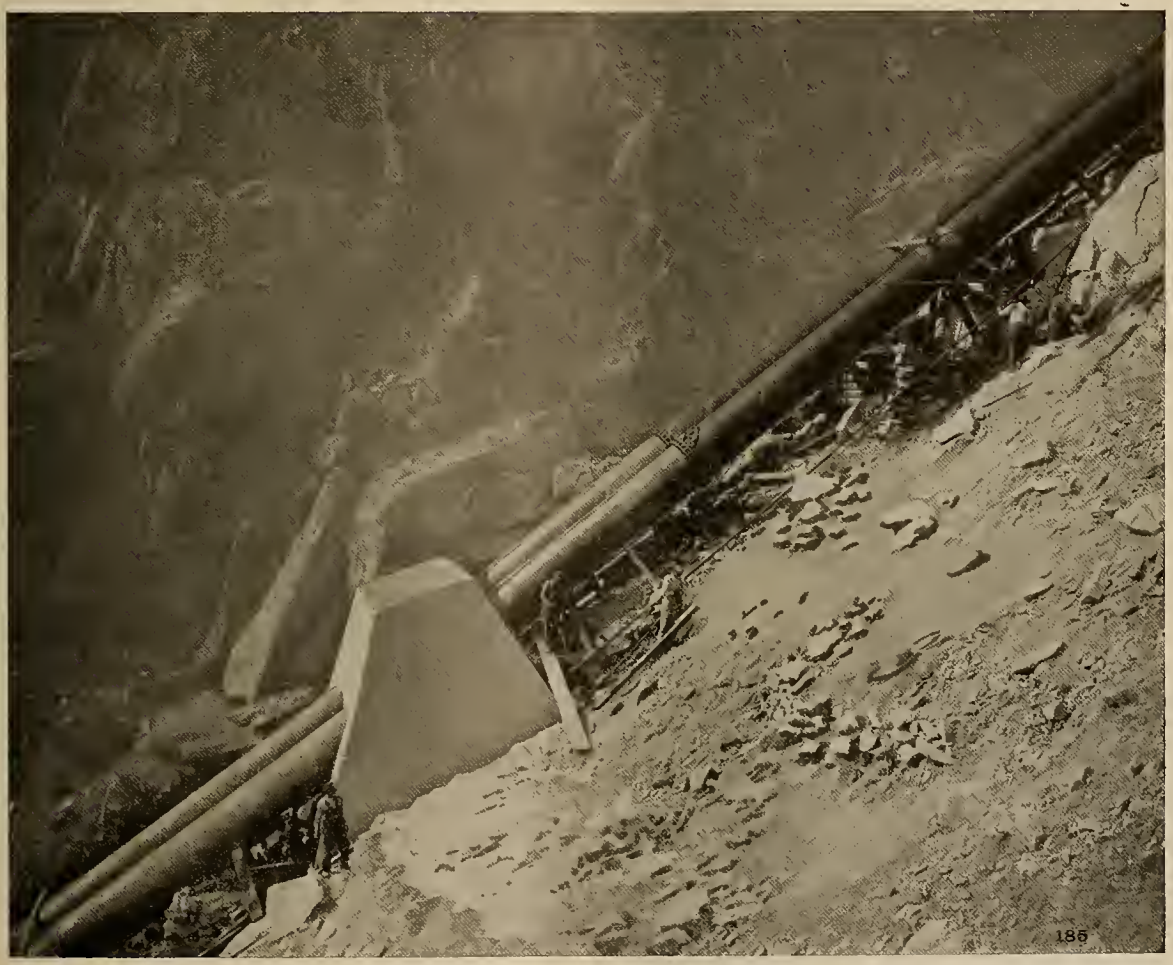
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXII SAN FRANCISCO, APRIL 25, 1914 NUMBER 17

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CONDUITS FOR WATER

BY GEO. J. HENRY.



High Pressure Lapwelded Steel Pipe Line of No. 1 Plant, Pacific Light & Power Company of Los Angeles at Big Creek. There Are Two Plants Each of 30,000 k.w. Capacity and Operating Under 2160 ft. and 1980 ft. Head Respectively.

From the time of the early Romans we find that man has conveyed water in pipes. These were at first very expensive, of small size and unreliable; the most frequent method employed was therefore by "aqueducts." These were usually very elaborate engineering works and occur today as some of the most interesting ruins of the past. They are to be found all over Southern Europe and to some extent on the American Continent. A fine example but recently displaced was that for conveying water from the springs at Chapultepec to the City of Mexico. Passages cut in the native stone were extensively used by the Moors in Spain and were a decided factor in making Moorish Spain a land of golden plenty.

Aside from a few isolated examples of metal pipes in early Greece and Rome in which bronze and copper and in at least one case silver pipes were used, wood seems to have been most extensively employed for the purpose. They were of an extremely crude character, little or no attention being paid to resistance to internal pressure and to resistance to flow.

By referring to Formulae (1) (Journal of Electricity, Power and Gas, May 25, 1912, p. 494) $V = \sqrt{2gh}$, we have the velocity of a body falling free-

ly. If instead of falling freely it is resisted by friction in any way we may write $V = \sqrt{2gh\mu}$ or $h = \frac{V^2}{2g\mu}$ (37)

where μ is the resistance. If a mass of water be falling in a vertical pipe, Fig. 34, we may represent the relative velocities at any cross section by the arrows and the quantity that will pass any cross section and therefore the quantity that will be discharged by the pipe will be less than if the same water cross section was falling freely. This is due to the relative velocity, of the first particles, to the sides, and the first layer particles retard those next to them and so in a series of increasing velocities the consecutive layers approach the center at which maximum velocity may be obtained. Also any roughness in the

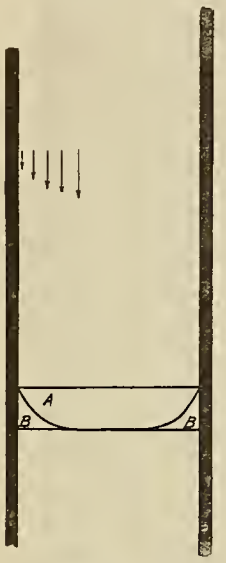


Fig. 34.



Fig. 35.



Fig. 36.



Fig. 37.

pipe surface (Fig. 35) will greatly increase the retardation due to eddy currents being set up as will also bends (Fig. 36) especially if these be, as frequently in practice, sharp angled (Fig. 37). Centrifugal force is also quite a factor in disturbing the smooth flow within the bend increasing of course with higher velocities of flow.

As the interior or contact surface is responsible for a retardation it is obvious that the larger the ratio

$$\frac{\text{cross section area of flow}}{\text{Wet perimeter or boundary}} \quad \ldots\ldots (38)$$

the less retardation and therefore the smaller the loss in forcing a given Q through the pipe or conduit. For a given area of cross section the circle has the least perimeter and we see at once a circular section is more efficient as regards friction loss than any other; and as it is also the best shape to resist internal pressure we find it almost universally used for pipes. Semi-circular steel and wood stave flumes are also coming into use quite extensively, merely as water carriers where no pressure is involved. In the case of an open conduit there is also a surface of retardation—the wetted perimeter and also the surface exposed to the air, which is retarded due to the relative velocity of the water and air. As would be expected there is a higher velocity to be found below the surface. If there be a wind from the direction in which the water flows the retardation will be greater and if with the direction of flow it will be less. This may seem like a small factor, but if the canal or flume be of great length it is one that by no means can be neglected, as for example, the "Los Angeles Aqueduct" across the Mojave desert where the prevailing winds are against the direction of water flow.

In taking water from a stream a point is usually chosen where the velocity is quite low and in such cases to acquire the velocity necessary in the canal or flume an entrance head or fall must be allowed for introducing the necessary acceleration. The value of this is at once found from the velocity formula above (37) for a velocity

V = 1 ft/sec.	h = .0156 ft.
2 "	1. "
3 "	1.26 "
4 "	1.56 "
5 "	.062 "
6 "	.14 "
7 "	.25 "
8 "	.39 "
9 "	.56 "
10 "	.76 "

and whenever a change in cross section occurs in any conduit there must be an inverse change in velocity for any given Q, and therefore there must be an allowance for velocity head + when the velocity increases and — when it decreases.

In flumes laid with a very small slope and at the entrance to tunnels and at sharp radius bends a careful consideration must be given to the velocity head to avoid a constriction of the flow or an overflowing of the sides. In the case of open flumes or canals, especially if long and in dry countries and on sunny hill sides, evaporation as well as leakage and seepage may become important factors as also the collection and safe discharge of storm waters that may enter at various points; for which spillways must be provided of excess capacity and sand boxes or traps with discharge outlets arranged at convenient points.

The transporting power of a current will be as the sixth power of the velocity (J. N. Le Conte—Elements of Geology) and water flowing 5 ft. per second will carry with it a piece of granite weighing about four pounds, at 1 ft. velocity one weighing only about 2 grains and at ½ ft. velocity about .03 grain. A sand box to be effective should therefore be arranged so as to allow the water to slow up to ½ ft. per second or less and long enough for this reduced rate of flow to continue until the particles have settled or "dropped through" the mass of moving water to the bottom.

The material of the sides and bottom of a ditch will of course vary in different localities and no higher velocity is permissible than that which will be safely resisted by the cohesion of such material. No safe rule of allowable velocities in earth or sand can be given. Careful intelligent observation based on experiment with the actual material is the only reliable guide. Usually, however, sand will stand at 1 ft. and clay at from 5 to 6 ft. per second and with a very good cement lining velocities of ten feet may be reached while with poor cement erosion will occur at five feet or even less. In some cases the settling out of transported matter requires an extremely slow velocity and in the case of one Western power plant employing a wooden flume over ten miles long, glacial sand is brought down in such quantities by the river and through the flume into a large forebay reservoir that a dredge has been kept in this reservoir a large part of the time to keep it from filling up with the silt which will not separate at any apparent velocity.

A surface of wood either as a flume or pipe allows a high velocity of flow and therefore a much smaller structure for conveying a given quantity than the usual ditch. A wood stave pipe offers decided advantages as a water conduit in place of a ditch; by far the greatest being the avoidance of the necessity of an even grade. In mountainous districts such a pipe may be carried up hill and down dale conforming to the easiest route, limited only by the hydraulic mean gradient and by the strength to resist pressure. High pressures should not be employed. Precautions must of course be taken in anchoring and in protection against freezing, preferably by burying the pipe and by at all times maintaining a velocity in the pipe. Stand pipes and air valves must be provided as on any other pipe line. Storm waters can not get in with their detritus; spillways are unnecessary, and evaporation and seepage are reduced to a minimum.

If a shorter route has been obtained even with the higher velocity probably used there will in most cases be less actual head lost than in the case of an open but longer ditch. One other great advantage frequently to be obtained by the use of pipe conduits is that where a dam is provided at the inlet from the river the pipe may be taken from the bottom but the pressure due to the depth of water behind the dam is not sacrificed but may be transferred to the pressure pipe or may be partially used if desired to increase the rate of flow during periods of maximum water supply. Sudden changes of velocity are to be avoided and an adherence to this rule is more important in the case of concrete and wood stave pipes than where steel (a more elastic material) is used.

To convey a given quantity of water (Q) through a pipe (P) with an actual difference in elevation A will result in a loss at entry to establish the increase in velocity P, a loss in the pipe due to friction on the sides and eddy currents, and at the nozzle due again to changes in velocity. If the total of these losses be placed equal to (f) we will have an effective pressure at the outlet of $H - f = h$, which resulting head produces the spouting velocity $v = \sqrt{2gh}$. As pointed out (f) is made up of several losses and the hydraulic mean grade is not necessarily a straight line. In the case of an open conduit the hydraulic mean grade is the surface of the water. In the case of a closed pipe it is that line which is the locus of the points to which water would rise vertically above the pipe due to the pressure. In the case of pipes used for water conduits only, as is usually the case in city water works, the entire head is used to force a quantity of water without reference to retaining any of the energy therein and in such cases the hydraulic mean grade line commences at the inlet water surface and terminates at the outlet water surface. In the case of a pipe line however for the development of power from the falling of water the water energy is to be conserved for transformation to mechanical or electrical power instead of being expended to force the greatest quantity through the pipe.

One of the best known formula and approximately correct for obtaining the velocity of flow in water conduits is that of Chezy, $V = C\sqrt{sr}$ .....(39) where C is a factor depending on roughness, r is the hydraulic mean radius (38) and s the slope. The velocity and therefore the quantity carried by a given pipe would vary as $\sqrt{s}$. In the case of a pipe for power development $s = f$ and we may say that Q is proportional to $\sqrt{f}$. The water quantity Q flowing in a given pipe line may then be represented by a curve of square roots where (Fig. 38) the ordinates are the effective heads $(H - f) = h$ and the abscissas are the resulting water quantities. For the purposes of demonstration the values are given on each line, and Table VII is given to make clear the calculation by which the curve of efficiency output is obtained. This curve indicates the theoretical energy contained in the discharged water based on different sized outlets being used with their corresponding resulting losses in the pipe taken into account.

The area of the inscribed rectangle D E B C will be a measure of the energy in the water.

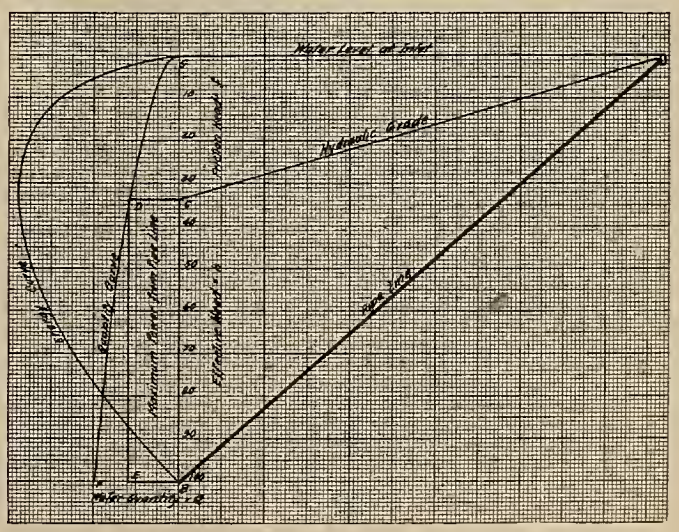


Fig. 38.

If the friction loss $f = G C$ the effective head $= BC = h$ the water quantity $B E = Q$; the total head $G B = H$. It will then be seen that when h is max. C coincides with G and $EB = Q = O$.

When Q is max. E coincides with F and $BC = O$ and $GC = GB = f$. Now the energy is proportional to the area BCDE and this area is greatest when $GC =$

$\frac{CB}{2}$ or the greatest energy is obtained when 1/3 of the head is expended in friction. This is however very seldom the most economical point at which to work the pipe line. To sacrifice 1/3 of the energy recoverable from any water fall for the purpose of a slight saving in the first cost of the pipe is a grave error. For example, if a pipe line would cost $10,000 delivered at the power site and develop 10,000 h.p. with 33.3 per cent loss, it would be better to design the pipe for only 5 per cent loss and we may then obtain $10,000 + 28.3$ per cent or 2830 h.p. additional by the extra expense of a larger pipe. It is obvious

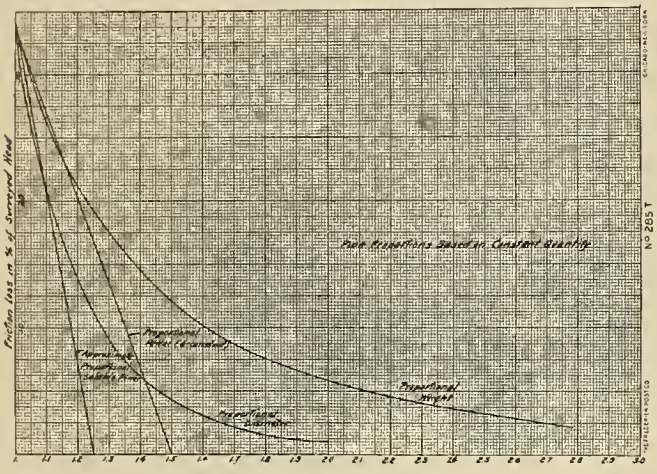


Fig. 39.

that to avail ourselves of this and with the same Q (5.77 in the above table) we must now have a friction loss of 5, or to put it in another way we must with a slope or friction loss of 5 be able to force $Q = 5.77$ through the new pipe where a $10,000 pipe would carry $Q = 5.77$ on a slope of 33.3.

From formula (39) $v = C\sqrt{sr}$ it is seen that in the first case $\frac{v}{C\sqrt{r}} = \sqrt{s} = \sqrt{33.3}$ and $v \backsim \frac{1}{d^2}$ and we may for approximate comparison assume C to be constant then for the same quantity of water.

$$\frac{\text{Const}}{d^2} = \sqrt{r}\sqrt{s} \text{ and } \frac{\text{Const}}{d_1^2} = \sqrt{r_1}\sqrt{s_1} \ldots\ldots\ldots\ldots (40)$$

and $d^2 \times \sqrt{r} \times \sqrt{33.3} = d_1^2 \times \sqrt{r_1} \times \sqrt{s_1}$. But $r = \frac{\pi d^2}{4d}$

$$\therefore d^{5/2}\sqrt{33.3} = d_1^{5/2}\sqrt{s_1} \text{ and } \frac{d^{5/2}}{d_1^{5/2}} = \frac{\sqrt{s_1}}{\sqrt{33.3}} \ldots\ldots\ldots (41)$$

$$\text{or } \frac{d^5}{d_1^5} = \frac{5}{33.3} = \frac{1}{6.63} \text{ and } d^5\sqrt{6.63} = 1.46d = d_1.$$

The weight of the new pipe will be increased in proportion to the diameter and to the thickness but the thickness $\backsim$ as the diameter hence the weight and (therefore very closely the cost) varies as the (diameter)^2 hence our new pipe will weigh and cost 1.46^2 or about two times as much. That is $10,000 additional gives 2666 h.p. more power available; an excellent investment in most cases.

If the first line were to cost $30,000, then by doubling this investment we could obtain 2666 h.p. additional from the pipe or at the rate of about $11.30 per h.p., which is still a most excellent investment. The additional cost of hydraulic and electric apparatus must be added to this to determine the entire additional cost but when this is done if the amount is less than the investment for power under the high friction loss then it is certainly economy to adopt the larger pipe line. These formulae and figures are only approximately correct and the example is here introduced only to show the importance of the friction loss in determining the investment warranted in the pipe. On account of the variation in cost of different sizes and thicknesses of material, due largely to factory conditions, transportation and raw material, each case must be carefully figured. A proper rate of interest and amortization must of course be charged against the increased investment just as against the balance of the capital invested in the plant. The general rule may be stated as follows: If the cost of all the hydraulic and electrical machinery and other expenses involved from the outlet of the pipe to the user that vary as the units of power that may be marketed (Foundations, buildings, crane, roads, pipe installation, canals or flumes and usually transmission lines and operating and maintenance costs may usually be eliminated from this item) are added to the increased pipe cost per unit of increased power obtained, and this does not exceed the entire cost per unit of power based on using the greater friction loss then such additional investment to reduce the friction in the pipe is justifiable. With this rule in mind and the use of the formula (40) which presupposes a definite water quantity available, we may get a very close approximation of the most economical pipe to use in any given case and to facilitate such calculations Table VII is given and the corresponding curves are shown in Fig. 39.

Table VII.

Effective Head. H — f = h.	Head Lost. f	Proportional water quantity discharged Q.	Energy remaining proportional to Q × h.
100 = H	0	0	0
90	10	3.161	284.49
80	20	4.472	357.76
70	30	5.477	382.39
66.66	33.33	5.77	384.62
60	40	6.325	379.50
50	50	7.071	353.55
40	60	7.746	309.84
30	70	8.366	247.98
20	80	8.944	178.88
10	90	9.487	94.87
0	100	10.	0.

Taking the maximum power output of a pipe in terms of the head we would have for a given Q the following relationship where h = 100.

If f = 33.3 = maximum power output d = 1 w = 1, then the proportional power output from the pipe is given in Table VIII.

In most cases judgment will readily determine the approximate economical loss to allow and the calculation of the pipe on this basis will at once give a starting point by which a close final value may be obtained from the curves in Fig 39.

Example.

Assume 20 cu. ft. per second is the flow available = Q, that the pipe is to be 4000 ft. long and the head 500 ft. Using riveted pipe and allowing for aging we will have a friction loss of about 20 ft. per 1000 in 20 in. pipe or a total f = 80. Assume the cost per unit of other apparatus = $50 per horsepower and that the power has a sale value of $40 per year—allow 10 per cent for fixed charges and 10 per cent for investment, then $20 per year capitalized or ($400 less 20 per cent, less $50)—$270 would be the value of each horsepower gained by reducing pipe friction.

The above 20 in. pipe would cost about $7000 f.o.b. Pacific Coast Terminal at present rates. From the curves it is seen that (80 being 16 per cent of 500) the diameter is as 1.16 is to 1.46 (5 per cent loss) for a pipe which will weigh $\frac{2.13}{1.34} = 1.6$ and proportionate cost $11,200 (25 in. mean dia.)

The saleable power will be about 50 per cent of the theoretical power (Journal of Electricity, Power and Gas, March 30, 1912, p. 288) and this would be about as $\frac{1.26}{1.43} = 13$ per cent increase in saleable power for the expenditure of $11,200 — $7,000, or $4,200. Under 420 ft. effective head 20 sec. ft. of water corresponds with 950 h.p. theoretical or 475 h.p saleable and 13 per cent increase would be 62 h.p. additional to sell, for $4200 increased investment in the pipe or at the rate of $68 per horsepower.

The comparative cost of the two pipes would be $\frac{7000}{950} = \$7.40$ and $\frac{11200}{1073.0}$ $10.40 respectively per theoretical horsepower.

If to obtain the same head the pipe would have to be 8000 ft. long, then a 20 in. pipe conveying 20 sec. ft. would have a friction loss of 166 ft. (or 1/3 the head) the power output would be 755 h.p. theoretical, and cost $14,000, and a pipe to give only 5 per cent loss would have to be 1.46×20 or 29½ in. dia. and the cost of the raw material would be 2.13 or $30,000. In this case the cost of 1073 — 755 = 318 additional horsepower would be $30{,}000 - 14{,}000 - \frac{16{,}000}{318.} =$ over $50 per theoretical horsepower for the pipe alone and combined with the increase in the other apparatus would run the cost to considerably over $100 per h.p. and while there are many cases where this is justifiable there are many others where it is not. For example it may be that dams, roads, transmission lines and other expensive fixtures have been necessary for the initial development and by them water is impounded in excess of the market for power for many years and that after the initial development additional power can be developed for $45 per h.p.—in such a case it would be economical to increase the 4000 ft. pipe to suitable dimensions for 5 per cent loss, but it would certainly not be economy to increase the 8000 ft. pipe to the 5 per cent loss although it probably would be wise to increase it to obtain only about 8 per cent loss. This would not apply with equal force where future additions contemplated additional pipe lines.

Table VIII.

Effective head. H—f=h.	Friction lost in per cent of surveyed head.	Proportional diam. of pipe, = d.	Proportional weight of pipe = w.	Proportional power output from pipe. Q = Const.
100	0			1.500
99	1	2.	4.	1.485
98	2	1.669	2.78	1.470
97	3	1.603	2.57	1.455
96	4	1.528	2.34	1.440
95	5	1.460	2.13	1.425
94	6	1.415	2.	1.410
93	7	1.365	1.86	1.395
92	8	1.330	1.77	1.380
91	9	1.291	1.67	1.365
90	10	1.261	1.58	1.350
88	12	1.227	1.5	1.320
86	14	1.189	1.41	1.290
84	16	1.158	1.34	1.260
82	18	1.131	1.28	1.230
80	20	1.106	1.22	1.200
75	25	1.059	1.12	1.125
66.67	33.33	1.	1.	1.

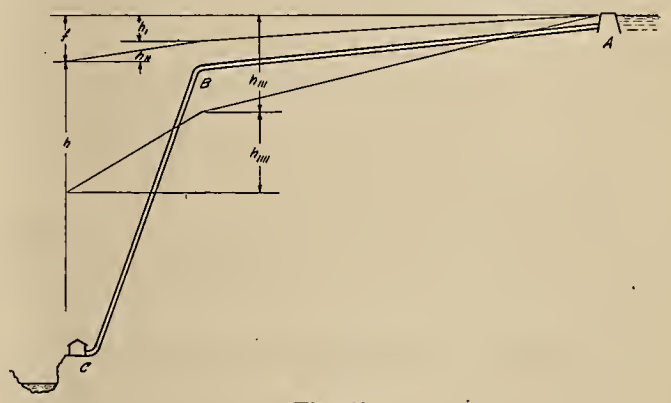


Fig. 40.

It is obvious from a study of the Chezy formula (39) that the slope s or friction head (a less confusing term where pipes are calculated for water power) increases as a function of the velocity V or quantity Q, and therefore that as the gates or nozzles are changed at the power house to vary the water quantity issuing

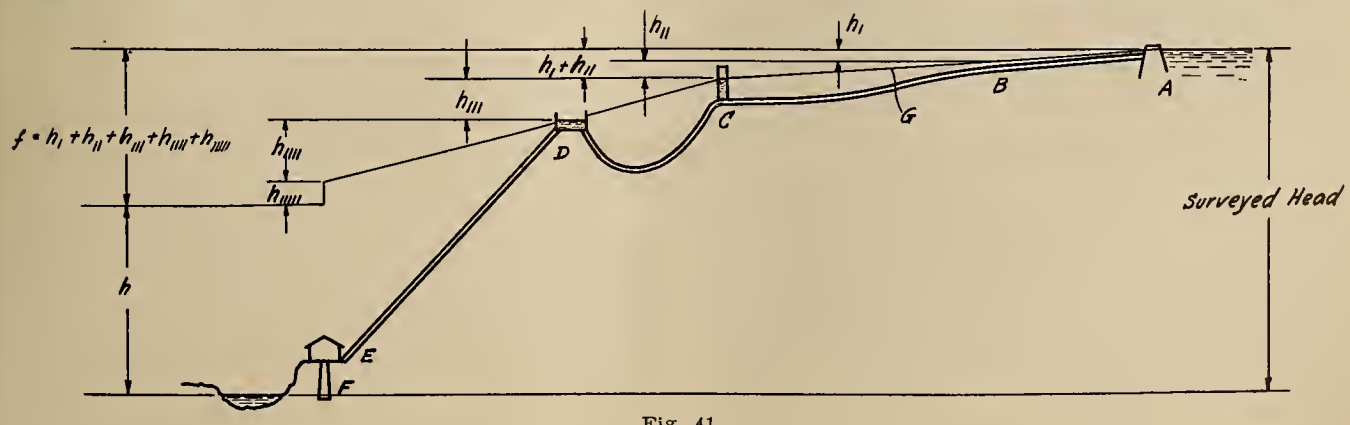


Fig. 41.

from the pipe that the friction loss varies. The hydraulic grade therefore varies as a function of the water quantity and is level when the gates are closed ($V = O$) and is drawn down to 1/3 of the head for maximum power (Fig. 38) and down to the nozzle for max. Q and Energy = O.

In the case of an open flume the hydraulic grade is the surface of the water. In the case of a closed conduit emptying below water into a reservoir it is a line from the surface of the water at the inlet to the surface of the water at the outlet.

Take the case of a compound conduit as shown in Fig. 40 where a dam is shown at A from which point the water is conveyed in a flume or ditch to the point B with loss = h_i here the construction becomes more expensive due to the broken character of the country and a wooden pipe is used.

From B to C this is carried up and down to suit the profile of the ground, keeping always below the hydraulic grade G. This pipe terminates in a stand pipe C and the friction loss is h_{ii} from C to the reservoir D is an inverted syphon with a loss h_{iii} from which the pressure pipe D. E. conveys the water to the power house with a loss h_{iiii}. The draft tube f discharges under the surface water of the river with a friction loss of h_{iiiii} and from our original surveyed head we must subtract the total losses $f = h_i + h_{ii} + h_{iii} + h_{iiii} + h_{iiiii}$ or $H - f = h$.

The flume, the tunnel, the wood pipe, the syphon and the pressure pipe will all represent different unit costs and their most economical sections and therefore slopes or friction heads may and probably will all be different. If practical it may be better to substitute a stand pipe for reservoir D as then when conveying less water (i.e. less friction loss) the effective head h will be increased.

If at any point the conduit projects above the hydraulic grade line, the flow will be retarded until a quantity is flowing that corresponds with an hydraulic grade line passing through that point, a steeper line beyond this point will by draft or suction be equivalent to increasing the head and will "draw" water over the high point (within the limits of vacuum) causing a negative or collapsing pressure.

In the case shown in Fig. 41 h_i = friction of pipe AB; h_{ii} = friction of pipe BC. If the pipe has been calculated for a friction loss $f = h_i + h_{ii}$ and the demand at the power house is increased (due to a break in the pipe or careless operating conditions) so that the hydraulic grade becomes $h_{iii} + h_{iiii}$. A negative pressure K, frequently, sufficient to collapse the pipe is caused. For this reason a stand pipe, reservoir or an air valve must be located at the point B or at every part where a sudden change to an increased slope occurs.

(The forcgoing is one of a series of articles on Elements of Hydraulic Engineering, each complete in itself, appearing from time to time in this Journal. They are copyrighted and all rights reserved by the author, Geo. J. Henry, consulting engineer, Rialto Building, San Francisco.)

PUBLIC POLICY OF PUBLIC UTILITY CORPORATIONS

BY JOHN A BRITTON.

(In this article the author emphasizes the importance of the individual employe in the carrying out of a successful public policy and states the basis on which that policy should be formulated. The article was first presented as a paper before a recent meeting of the San Francisco Section A. I. E. E. The discussion is also valuable and will appear in the next issue.—The Editors.)

The subject of my address this evening is an hackneyed one, upon which volumes have been written and many theories advanced since ever corporations were.

Unfortunately, no two minds have ever agreed as to the question of the public or policy, and I am apprehensive that I will but add one more to the many diverse views, and that when I pronounce the benediction, you will be no farther advanced in your opinion, and may only have another theory to place in the dusty pigeon holes of your memory.

Practice and theory are at the ends of two widely separated lines; sometimes if either one or the other becomes elastic they may touch each other, and it has been my purpose through life to at times grab both lines and force them together, satisfying myself that it can be done.

Practically at the present time corporations are not allowed to have any well canned and preserved policy of their own, they must follow those made for them, and this is best illustrated perhaps by the following excerpt from a Pittsburg paper:

The office boy, responding to a visitor's call, had the following interview, as illustrating the activities of the personnel of a public utility:

"Where's the president of this company?" asked the man who called at the general office.

"He's down in Washington attendin' th' session o' some kind uv an investigatin' committee," replied the office boy.

"Where is the general manager?"

"He's appearin' before th' railroad commission."

"Well, where's the general superintendent?"

"He's at th' meetin' of th' legislature, fightin' some new bum law."

"Where is the head of the legal department?"

"He's in court, tryin' a suit."

"Then where is the commercial agent?"

"He's explainin' t' th' supervisors why we can't reduce the rates."

"Who's running the blame company, anyway?"

"The newspapers and the legislatures."

Now, while regulation has brought about a very different and, it may be said, a vastly better condition of things generally as between most of the Public Service Corporations and the public served, it has not deprived these corporations of the right and privilege of promulgating lines of policy, but rather has it forced upon the corporations the necessity of laying down hard and fast rules, that the public may understand with full knowledge that each member of the body politic stands in the same relation to the corporation as his fellow.

Public policy, as the phrase is understood, means the moral attitude of a corporation towards those with whom it comes into contact, and is generally measured by the mental length, breadth and thickness of each particular person contacted. It means, as a rule, pursuing the path of least resistance, a recognition to the ninth power of the other fellow's rights, without losing your own self-respect, a subordination of personal preferences to general orders.

Public policy is not a term, however, that should be applied to utilities exclusively, for it is applicable to all forms of business having private or personal or public relations with the masses, such as any kind of trade from the itinerant peddler to the banker; your grocer and haberdasher; your bootblack or your wholesale merchant, and all of the relations should have the deep and full significance of true friendship, for of a right certainty, no business, no trade, and no commerce, as between people, or between nations, can flourish, and ultimately succeed, unless it is founded and fixed on the rocks of friendship and true fellowship.

There are classes of men who perhaps do not need this talismanic guide to true success, and they are those of the vagrant rich and the vagrant poor, both undeserving and both intolerable, and both aiding and abetting in the retardation of all true principles of business and business growth.

Now let us analyze the conditions that create or destroy the friendship of the masses and thereby create or destroy the policy of corporations, for it is of that class I am supposed to deal in my remarks tonight.

To my mind, the most important factor entering into the creation of a favorable policy, and perhaps in its final analysis an unfavorable one, is the question of personal equation—and by that term I mean the atmosphere that surrounds each individual in his or her attitude toward, and conception of, the problems that each are daily and hourly confronted with.

Most, if not all of you before me tonight are young men, just entering upon your separate spheres of activities as your early training, inclinations, or the fates have determined and directed. You are or should be unquestionably imbued with the sincerest of desires to make good in life, and to achieve your ambitions, for you would be less than men made of red blood and enduring fibre of bone and muscle did not have that ambition and faith in yourself, and you will then succeed in that particular line of life which you have determined, and reach the goal that your ambition has set as the ultimate mark of your success in life.

As reasonable thinking men, therefore, you must realize that alone you are helpless, that if you wanted to become an independent spirit, reckless of precedent, reckless of rules and customs, and reckless of the interests and feelings of your fellow men and women, you would soon become mere flotsam and jetsam on the world's swirling waters of business. You must, and I am sure do, thoroughly and sincerely realize the importance of so governing your lives and conduct in every day concerns that to assume any place of strong recognition in the marts of trade and commerce, you must be a close student of your fellow men, of his wants and desires, and above all must you realize that selfishness cannot in this world of progress become to be regarded as anything more than minuteness of intellect.

Assuming, therefore, that in the struggle for a position worth while in life, due consideration must be given to the desires and opinions of others, we reach a common plane from which we can coolly and dispassionately survey the situation and agree that beside ourselves there are others whose rights we must recognize and respect. Then perhaps will there be an approach to that millennium when the load factor and the power factor of human life will have reached unity.

This ability, through proper education of the personal equation, to recognize the rights of others, is the first step that leads eventually to a consummation of the ideal public policy.

It was the immortal Lincoln who said "You can fool a part of the people some of the time, all of the people a part of the time, but you can't fool all the people all of the time," and no matter how brilliant you may be in your schemes, no matter how many times you may put something over, mark me the day will come when these chickens will come home to roost, and golden eggs will become gilded ones.

A corporation, in its determination of a policy that will place it before the public in a favorable light, is dependent for such public favor and its continuance, not altogether upon the men in the mahogany chairs, but to a large degree upon such men as you, who daily come face to face with the public in all its moods and tenses, and while in a measure the men reflect the wishes of their leader, his wishes may be set aside by lack of that personal equation which I have before referred to. If a man arrives at his station the morning after, with a grouch (unfortunately some men do not require the night before to produce grouches, they carry them with them all of the time like an elephant's trunk), and such grouch is due to a disordered stomach, or a merry tango or tangled night, if therefore, you cannot smile without hurting your face or that of your neighbors, you are setting an example before that portion of the public which meets you, of a deficient interest in its behalf that is reflected as many times as the myriads of minute waves that are made by the pebble thrown into the center of the tranquil pool—the effect extends into infinity.

You are, by your daily conduct, establishing a reputation, not only for yourself, but your firm or corporation, that thousands of words and other efforts, promulgated from the office of the General Manager, cannot change or alter—be this reputation you establish for good or evil; how much better then to establish it for good, so as to create that public policy which is desired, for the poet well and truly says:

> "The purest treasure mortal times afford
> Is spotless reputation, that away
> Men are but gilded loam, or painted clay."

It is often said like master, like man, but that saying, in this age of wide diversity of activities of public utilities, coupled with the multiplicity of men engaged, is only partly true. Policies are seldom di-

rected by the governing head, they arise in the first instance from the rank and file.

All of that which I have heretofore said leads up to, but at the same time forms an integral part of my subject, and outlines the matters and things that are important and fundamental to the man in the conning tower as he views the fighting and firing lines, for he must feel helpless and hopeless, unless below him things are in shipshape, and team work is being pursued, from the stoker in the bilge hole to the captain on the bridge.

In seeking for the means whereby a proper public policy may be created, my mind has continually harkened back to the days of my youth, when corporations as they are now known were an unknown quantity, but when we were taught the simple lessons of peace and goodwill, and when in the absence of the disturbing factors of daily life now so prominent, these lessons took hold and held fast like hoops of steel. For in the formative period of fifty years ago, as compared to the present era, the world was primitive, transportation was limited in scope and capacity, the world was indeed vast, there were no telegraphs to girdle the earth, no telephones to minimize distance, no electric lights to make, mark and mar the great white ways, the flickering candle, sputtering oil lamps and very occasionally the gas jet, were our only artificial means of light and so in the absence of these diverting things of our twentieth century civilization, the mind had more time to ponder and reflect, and this with me remains, and has and will remain, that which I was taught in Sunday school, of my duty towards my neighbor, and it comes nearer today to being a perfect answer as to what should constitute the public policy of a corporation that I will quote it for your benefit:

"My duty towards my Neighbor is, to love him as myself, and to do to all men, as I would they should do unto me: To love, honor and succor my father and mother; To honor and obey the civil authority; To submit myself to all my governors, teachers, spiritual pastors and masters; To order myself lowly and reverently to all my betters; To hurt nobody by word or deed; To be true and just in all my dealings; To bear no malice nor hatred in my heart; To keep my hands from picking and stealing, and my tongue from evil speaking, lying and slandering; To keep my body in temperance, soberness, and chastity; Not to covet nor desire other men's goods; but to learn and labor truly to get mine own living, and to do my duty in that state of life unto which it shall please God to call me."

There is another rule of conduct usually designated as the Golden Rule: "Do unto others as you would they should do unto you," and modern ethics has added, "but do it first," and therein in this modern appendage lies the crux of our undoing.

Corporation policy should consist in so training subordinates that they will learn, teach and apply the foregoing precepts, that they will have faith in the integrity of those whom they represent and reflect that faith, and impress the public with their sincerity in the promulgation of such integrity, for personally I have no use for that man, who is not loyal to the interests which he represents—he is, if taking compensation from a company whose actions he does not and will not defend, or whose policies he does not or will not reflect, acting every day a living lie, and is therefore unworthy of confidence, and some day his misdeeds will be disclosed.

"I would rather be a dog and bay the moon than such a Roman" said Brutus, and any man false to his trust should be thought less of than a moon-baying dog—to such a man Benedict Arnold would by comparison be classed a hero.

Having dwelt upon the relation of the public policy of a corporation that is borne by the employes to the consumers of the corporation, and which relation it seems to me to be of primary importance, we will now take up the question of relation of the corporation itself to the public.

First and foremost as a factor overlying the broad question, is the matter of service given to the public by the corporation; for in these sensitive days, days of criticism and fault finding, the service of a corporation must be, as was Caesar's wife, above suspicion. People are intolerant today of mediocrity; the standards of excellence in all of the walks of life have been so raised by necessities that nothing but service approaching perfection will be tolerated, and no public service corporation can hope to maintain the favor of the public, no matter how exact its every course of conduct may be, unless it gives to the people that which they have a right to demand and which the people expect by reason of the tax which they have to pay therefor.

This service in these days of transportation by means of electrically propelled vehicles, in the large manufactories dependent upon electric service, in the general lighting of buildings, both commercial and residential, and for gas in continuity of supply because of its uses for domestic and industrial purposes, makes for and emphasizes the necessity of this feature of public policy.

And aside from the question of continuity of service must, of course, be considered the larger question of perfect service and the furnishing of a stable, equal character of product. The reputation of firms manufacturing food products is maintained only by a constancy of the quality of the commodity furnished, and this should be more particularly so in the question of commodities furnished monopolistically by public service corporations, for there is generally no escape from the service rendered. The element of competition, while being largely destructive on questions of revenues to the corporation, is not largely extended in matters of service to many, one company usually retaining the service of the majority in any community. It should, therefore, be the duty of the corporation and its managers to see that its forces are so organized, its spirit of discipline so maintained, and its team work so arranged, that its policy in the matter of service can never be questioned; and one of the ambitions of the young engineers of today having to do with the service of corporations, should be to strive for the maintenance of that high standard that he knows the public is entitled to and requires; and it should be the policy of the corporation to so educate these engineers as to produce in them nothing but that desire.

Next to the question of service comes the question of personal contact with the consumer; that personal contact is reflected from the very highest by the personal equation of which I have before spoken, in

raising the individual to a realization of the deeper question of the corporation policy as going to the ideals of the management. Courteous treatment of consumers to produce a feeling of interest in the corporation, cannot be fully engendered in the rank and file of employees unless that same personal feeling is brought about by the courteous treatment of the employees by the corporation head. This particular phase of social economics is being broadly viewed as a necessary self-protective measure by all large employers of labor. Rather let me here correct the ordinary expression, which I have unconsciously used, of large employers of labor, and say the paymasters of labor, because concretely considered, corporations are after all but the fiduciary agents of their staff. The sale of their commodities to the public, and the revenue obtained thereby, are retained largely in trust for repayment to those employed. It is a reasonably safe assertion to make, that in the corporations known as quasi public, more than 90 per cent of their gross receipts annually are paid out in the form of payroll checks, not only to its own employees, but to the employees of those from whom it buys materials and supplies. I had occasion to say in a recent lecture delivered before the San Francisco Chamber of Commerce, that the stockholders of the public service corporations of this state receive less than 2 per cent upon their equities in the property, the bulk of the money received going back to the ultimate consumer, directly or indirectly.

Returning again to the subject of the courteous relation as between the paymaster and the recipient, we will find that the moral tone, whether it be of a high or low standard, will more or less permeate the masses and be reflected in all relations with the public. The public as a general rule is an uncomplaining body and will put up with many inconveniences without demur; the percentage of those needing close attention being the minimum, there is every reason, therefore, why the effort of public service corporations should be directed along the line of least resistance, for resistance provokes friction, and friction heat, and this element heat in argument and discussion must be reduced by the application of the lubricating oils of kindness and courtesy, and it takes but little time and effort to accomplish that most desirable end. Corporations to provoke the proper public policy should zealously guard every utterance, to see that nothing is said or authorized to be said on its behalf that is not an absolute truth. It should never forget an obligation, and no matter how burdensome it may become, due to errors of judgment, it should be carried out.

Little things mark men of greatness. The bigger things of life and in the attitude of men and peoples, generally take care of themselves. One of the little things which very often provokes an antagonistic public feeling is the disregard by responsible officials of a company of the ordinary courtesies that go towards acknowledgment of letters. In my experience of many years I have found more difficulties to overcome, more sores to heal, and more damage resulting from the indifference of officials of the corporations in replying to communications received from their business associates or from complaining customers. A signed letter to an appeal, whether right or wrong, acknowledging receipt and promising attention, is often the salve which heals the wound, imaginary or otherwise, of the consumer; it paves the way to a better realization of the duties and obligations of each other.

The personal appearance of those coming into contact with the public is another one of the things that make for a public policy favorable in its character, and it is too often not appreciated, either by the management or by the men themselves. The man who is clean in his personal appearance is pretty apt to be clean in his habits and morals, while nothing discredits one so much as lack of pride in one's personal characteristics of this character, and friends are easier gained in contact with the public by one who approaches the public bearing evidence of that cleanliness of person and mind.

Summed up, the whole question as to whether a corporation can and will be popular with the people, to the same degree that a storekeeper seeking trade is, will come only from following the very fundamental principles that since the existence of time have been laid down for the betterment of the human race, and just as soon as corporations realize that they have no particular God-given rights, that they are the servants of the people, that they have a commodity to sell which can only be profitably sold by its presentation in an absolute business way, and just as soon as the public appreciates that a corporation serving the public is but an adjunct of the merchant class, that it is seeking to build up and not destroy, and as soon as politicians by proper regulation are made to feel that their sphere of public activitiy will no longer lie in the unwarranted and uncalled for abuse of corporations, nor more than it would lie in the unwarranted abuse of the merchant or commercial class—then will come that era for which all honest men are striving, which is, to be permitted to do its business on a business basis, and to obtain for its commodity a proper return upon the moneys actually and honestly invested in service to the public; and as a proof that there is nothing new in the dissemination of questions of policy, and that it was preached and practiced years ago and made the foundation for the betterment of man, it is perfectly appropriate at this time and in closing to recite to you, for your benefit and for your digestion and analysis, the advice which Polanius gave to Laertes, his son, as is set forth in the book of Hamlet.

Look thou Character—
Give thy thoughts no tongue
Nor any unproportioned thought his act.
Be thou familiar, but by no means vulgar.
The friends thou hast, and their adoption tried,
Grapple them to thy soul with hoops of steel,
But do not dull thy palm with entertainment
Of each unhatched, unfledged comrade.—Beware
Of entrance to a quarrel, but, being in,
Bear it that the opposer may beware of thee.
Give every man thine ear, but few thy voice.
Take each man's censure, but reserve thy judgment.
Costly thy habit as thy purse can buy, rich not gaudy,
For the apparel oft proclaims the man.
Neither a borrower nor a lender be,
For loan oft loses both itself and friend,
And borrowing dulls the edge of husbandry.
This above all—To thine ownself be true,
And it must follow as the night the day
Thou canst not then be false to any man.

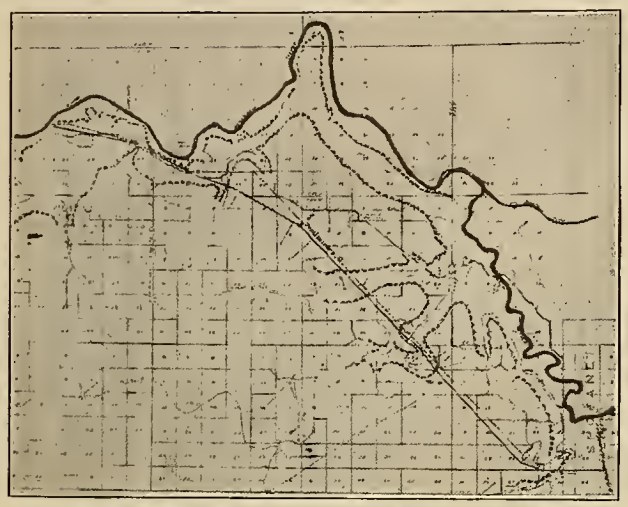
LITTLE FALLS TIE LINE.

BY JOHN B. FISKEN.

[Concluded.]

Location.

This is a subject that is always deserving of very great consideration, and involves a great many factors. The more nearly a line approaches a straight line the better, both on account of saving in costs, and more particularly on account of being more reliable and having better operating features. Sharp corners and turns should always be avoided for the reason that they call for special and expensive construction. A tower, unless specially designed to withstand the downward stress imposed by a guy should



Map Showing Location of Little Falls Tie Line.

never be guyed except in a horizontal direction. The author has this fact impressed upon him by seeing some towers very badly deformed by being guyed when no provision had been made in the design for these unusual strains.

As a general rule a line should be built straight even though it should cross private property, provided the cost of the necessary right of way does not exceed the cost of building by another route. The cost of the right of way may in many cases, from an operating standpoint, exceed considerably the saving by building around, but the amount of this excess is almost impossible of estimating and has to be left to the judgment of the locating engineer. A right of way has to be acquired when towers are to be used as these cannot be located on country roads.

The map shows the direction of the line and makes the location easily understood.

Right of Way.

Before the permanent location was entirely finished the right of way agents were at work. The obtaining of a right of way such as has been indicated is a very slow and tedious job. Absentee owners have to be found and frequently they are found in foreign countries. Unsettled estates are encountered and probate court proceedings or friendly condemnation suits are necessary. The owner of some five acre tract or a quarter section of good basaltic rock with some scrub pine, a small corner of which may only be crossed by the wires requiring no towers to be set on the land is too busy doing nothing to make up his mind. In such a case repeated visits from the right of way agent are necessary before the papers are signed up. Then again the thrifty farmer who had sworn to the assessor that his land is not worth over $10 an acre finds a line of little white stakes across it and suddenly wakens up to the fact that these stakes have increased the value of his land twenty fold. Then the lawyers and a jury in the superior court get busy with the condemnation proceedings and the farmer in the end finds that he has not as much in his pocket as he would have had if he had settled with the right of way agent. To the credit of the farmers in the Inland Empire be it said that such condemnation proceedings seldom have to be resorted to. A company acquiring a right of way such as indicated must however expect to pay at least twice what the land is worth.

Two kinds of right of way were acquired. One consists of an easement to clear the right of way and build and maintain the line and patrol road. In this case the title to the land remains with the owner. The other kind is when a warranty deed to the land is given. In either case where the right of way is through timber the right is given to cut any danger trees off the right of way. When the nature of the ground is such that a construction and patrol road cannot be built with reasonable grades it is necessary also to acquire the right to build a road off the right of way.

The Construction Work.

The right of way was cleared of all trees and brush. The trees in the majority of cases were cut into saw logs and marketed. In a few cases the trees were cut into cord wood. All limbs, brush and shrubbery which were not of use were burned, leaving the right of way clear and open. On the total of 361 acres of right of way the timber cut amounted to 833,798 board feet. A wagon road already referred to was built along the right of way which not only facilitated the delivery of material for the line during construction but is now used by the patrolmen in making their regular patrols. This road is not to be compared with a public highway, but is a good serviceable road, although narrow, as all the logs from the right of way and all construction material had to be hauled over it.

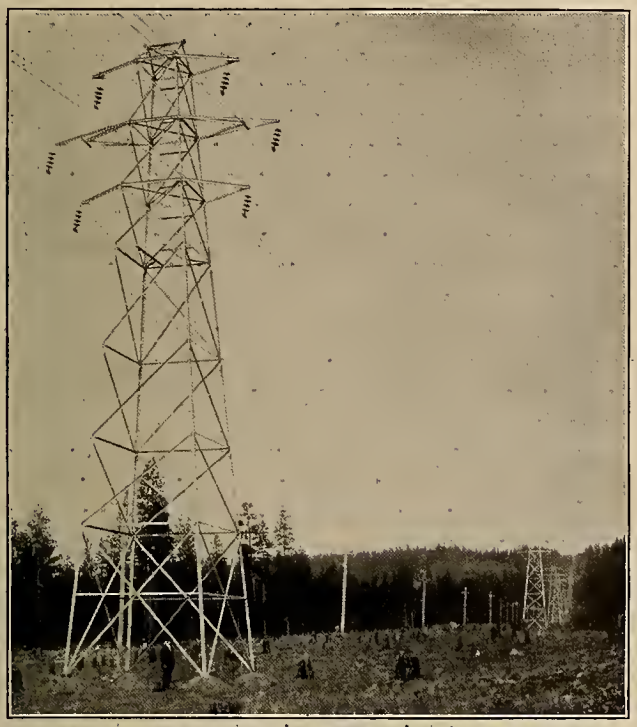
About eight months' time was required for the clearing and road building, all the work being done by one crew, ranging in number from 30 to 90 men. This crew moved camp four times, or camped at five different locations, to cover the whole length of line. Usually the plan was to work about three miles from camp each way before moving.

The organization of the clearing and road crew consisted of, a foreman, a sub-foreman, a team foreman and timekeeper, a cook, one or two cook's assistants, according to the size of the crew, teamsters and laborers. This crew usually had five or six four-horse teamsters because of the large amount of logs to be handled and decked. They also distributed all the tower steel and wire at pre-determined locations.

A small crew was started setting a few of the footings for the towers before the tower steel arrived. No separate camp was maintained but they worked along with the clearing crew.

When the tower steel arrived, tower assembling and erecting crews were put out. They also set the remainder of the footings for the towers. Three crews were used, one crew being in the field about four months and the other two crews about two months each. The first crew moved camp twice while the others moved only once. The size of the crews varied from 25 to 50 men.

The organization of each crew was practically the same, consisting of a foreman, three sub-foremen in charge of the assembling crew, erecting crew, and laborers; a timekeeper, a cook, cook's assistants and two teamsters. The balance of the crew was made up of riggers and laborers.

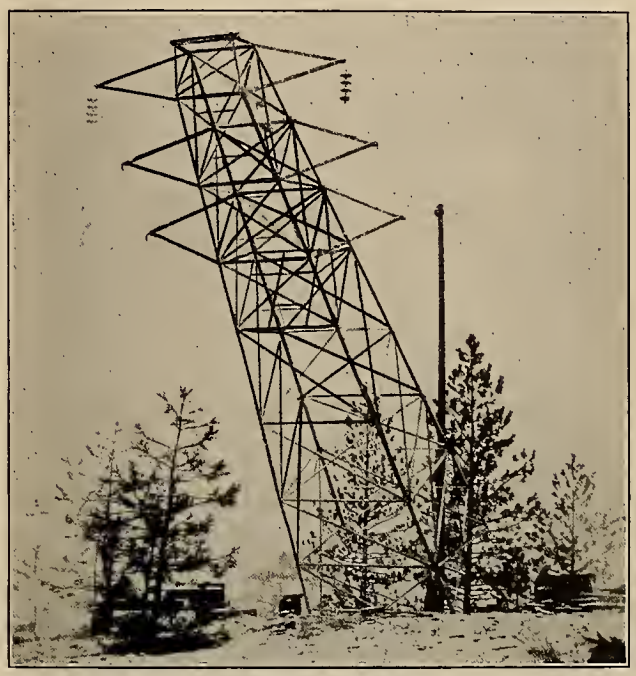


View of Tower Line and Telephone Line Showing Typical Clearing; Also Showing Re-arrangement of Cross-arms.

The first footings were set by means of a template made up of angle irons. At each corner of this template shoes were placed, having the same batter and shape as the tower legs. The holes were dug, then the footings were lowered into the holes. The template was then placed and leveled and the footings attached to the shoes and adjusted until the shoes and footings were in line. There were two main objections to this procedure, one was the weight and unwieldiness of the steel template and also its tendency to get too hot to handle with comfort. The other objection was that after the footing was set in place and the earth thrown back into the holes, strains were produced between the template shoe and footing and when the bolts were loosened, the footings would spring out of place and alignment.

The next method of setting footings tried was to set them by means of chalk lines and a plumb bob over each corner, then moving the free footing to position and grade and slowly back-filling. This method gave a more accurate placing of footings, although it was slow work yet not slower than using the steel template, considering the time necessary to assemble and take it apart and transport it between towers.

The third method used was to raise the tower until nearly vertical, then bolt two footings which were already in the holes, to the tower legs; pull the tower a little past vertical, resting on the two footings in the holes, slip the rear footings into place, bolting them to the towers. Then the tower was leveled by raising or lowering either the front or rear legs. Toward the last of the work, one foreman used a very simple wood template made of 1 x 6 in. lumber with the proper batter. This was leveled with a spirit level and the free footings were fitted to the corners. This was the simplest method tried and by far the cheapest and quickest. The towers set up on these footings just as accurately as they did on those where painstaking care was made to get them within a sixteenth of an inch.



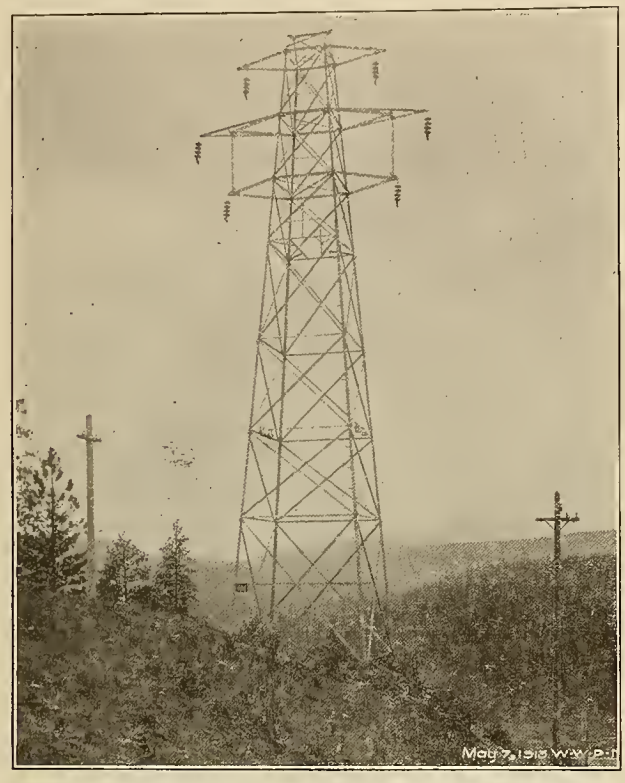
Erecting a Tower.

The tower steel was received at the various railroad distributing stations, six in number, in bundles, similar pieces being together. The steel was delivered at the survey stations designated for tower locations. When the assembling crew came to the holes, two legs were laid out with the ends near the holes. Then the pieces that made up two of the sides of the tower were laid out in place on the ground and the two sides of the tower were assembled first. These were then raised to a vertical position and the top and bottom panels were put in. Every man in the assembling crew had his certain pieces to pick out and assemble.

Next came the erecting crew. The erection was done by means of a gin pole about 35 ft. high. At its foot was attached a crab or windlass, by means of which the tower was raised into position. The gin pole was guyed by two side guys, a back guy and a front guy which was laid out at an angle so as not to interfere with the raising of the tower. These guys were ½ in. steel cable and were attached to trees if available, or to buried anchors. The main raising

cable was a 5/8 in. steel cable running through double sheave roller bearing steel blocks.

The gin pole was dragged between towers by a team, with all the rigging attached and its butt was placed ahead of the tower, location on line; one of the blocks was attached to the tower near the middle cross arm by means of a chain encircling the tower. The pole was then raised off the ground by hand. Then the team was hitched to the fall line and the pole pulled into place and guyed. The line was then attached to the crab and the tower raised. As the tower was being raised, it was guyed by both a back guy and side guys. After the tower was permanently in place the gin pole was lowered by means of its own weight being handled by the cable through the block on the tower. It was then pulled to the next tower location and the same operation repeated.



Crest Tower at Little Falls, Cross-arms Rearranged for Heavy Vertical Stress.

The organization of the stringing crews was similar to the assembling and erecting crews except that there were not so many sub-foremen for the work was more centralized. The ground wires were strung first. The reels were jacked up and the cable pulled out by team. It was then put in position, pulled to tension and fastened. Dynamometers were used to pull the cable to tension, the foreman noting the temperature and from a stringing chart determining the tension required or the prevailing temperature.

The aluminum conductors were handled in a similar manner except that more care was taken not to nick or scar the cable.

The Operation of the Line.

In the three years that the line has been in operation, the insulators have given very little trouble. Two of them have been damaged by lightning but in each case the top and bottom units were the only ones damaged and the line was kept in commission, using the remaining two units, until repairs could be made. Two insulators have been broken, presumably by being shot with a gun.

The first winter the line was in operation, trouble was experienced in certain parts of the country where it traversed frost regions. The line would go out but no one would know the cause. When the line was patrolled, the conductors were found to be pitted and burned in the spans between towers.

After careful study and a series of tests, the conclusion was reached that the trouble was caused by the frost dropping off a conductor in one span and still remaining on the conductor in the adjacent spans. Then on account of the added weight in one span and the lighter weight in the other two, and also the swing of the suspended insulator, the loaded wire approached the wire below it and the lighter wire, the one above it, causing the trouble. This same condition could happen in two wires at the same time with reverse condition of loading and the wires would pass each other in the span.

Many other companies operating tower lines in which the conductors are in a vertical plane or nearly so, have had the same trouble whenever the lines pass through frost zones.

This condition was remedied by rearranging the cross-arms, putting the conductors in a triangular shape. The top insulator support was moved in, while the middle insulator support was extended and the lower cross-arm remained as before. One half-tone shows a crest tower which is provided with posts and bracing to ease the downward pull. Since this change has been made no trouble of the nature indicated has been experienced.

The line which is 28.04 miles in length is patrolled once a week regularly and more frequently when weather conditions are such as to make it advisable to do so. This work is done by two patrolmen, but they have charge of other lines as well as the Tie Line.

For the convenience of the patrolmen a telephone line has been built on the same right of way as the Tie Line and at convenient intervals call boxes have been installed so that at all times the patrolmen can be in close touch with the office.

The greatest commercial value of wireless in the United States is for communicating between ship and shore or between ship and ship. Transatlantic communication has been established between the government station at Arlington, Va., and the Eiffel Tower in Paris, as well as stations at Panama and San Francisco, but this is only occasional and the service is not open to commercial business. Between the Canadian station at Glace Bay, Nova Scotia, and the United Kingdom an immense volume of press communication is carried on, most of the news from London and from the continent of Europe which is printed in the newspapers of the United States and Canada, according to one statement, being sent by wireless to Glace Bay and relayed by cable or overland telegraph to New York and the other large centers. Service is also available to Honolulu and to the West Indies and is utilized to some extent.

ELECTRICAL CONTRACTORS' DEPARTMENT

IS UNDERWRITER'S INSPECTION NECESSARY IN OREGON?

BY F. D. WEBER.

(Continued.)

To combat the fire loss, in addition to electrical inspection, the following methods are used by the National Fire Protection Association, and the National Board of Fire Underwriters:

Common Hazards, which are classified as simple carelessness, use of matches, metal ash cans and waste cans instead of wooden receptacles, chimneys and flue construction, heating apparatus including stoves, furnaces, etc., electric wiring, fire stops in buildings, building materials and construction, they endeavor to regulate by city ordinances.

Special Hazards, which are classified as lightning, fireworks, other explosives, petroleum, gasoline, etc., and the special hazards incident to various manufacturing operations, they endeavor to regulate by city ordinances and building codes.

Educational measures such as printed circulars, articles in magazines and papers, standard specifications for construction and apparatus.

Inspection Bureaus, such as deputy fire marshal, who are supported by the insurance interests and given the police authority from the municipalities. These officials are supposed to inspect and report regarding all common and special hazards. It is only possible to have these inspection bureaus in the larger municipalities.

State Fire Marshal. The insurance interests endeavor to get the office of State Fire Marshall created in all the states to handle the rural districts, suppress arson and in every way diminish the fire loss. The difficulty in getting this official appointed is the fact that the states generally desire to throw the burden of support upon insurance interests.

National Board of Fire Underwriters' Reports. These reports are made by a special committee of engineers representing the National Board of Fire Underwriters and consists of a detailed report covering the conflagration hazard, water supply, all manners of inspections within the city reported on and contain recommendations for improving conditions.

Form K No. 31

UNDERWRITERS' EQUITABLE RATING BUREAU

ELECTRICAL REPORT

Oregon City, Clackamas County, Oregon

Original Inspection, July 10 to 16, 1913.
Re-inspection, January 14, 1914.

The Portland Railway, Light & Power Company supplies electric energy from the hydro plant within the city limits. One 2300-volt primary circuit is used for all incandescent lighting and motor load. One arc circuit of a total voltage of approximately 6000 volts supplies 69 lamps of 5.5 amperes and 85 volts.

No street clusters used.

Pole line construction in fair condition.

Interior wiring in bad condition.

The city does not maintain inspection, but this Bureau has taken steps to secure the enactment of an ordinance to provide such.

Telephone and telegraph instruments are protected by fuses and arresters.

The municipal fire alarm system is hardly worthy of mention, there being but three boxes of the Gamewell type. The line construction and system is not standard.

Electrical Report of Bureau; Page 1 of Form K.

These reports are made every five years and cover all important cities of over 100,000 population.

Fire Patrol. The insurance interests in nearly all the cities of the United States maintain a fire patrol which does everything possible to alleviate the insurance loss from water and smoke. They also carry small fire fighting apparatus and many times reach the fire before the fire department. In this way, many times an appreciable amount of salvage is obtained.

INDEX OF DEFICIENCIES

1. Unapproved coed adjusters.
10. Attics not properly bored and bushed.
11. Attic inaccessible.
51. Cords too long, (a) or used other than as pendants.
52. Coeds in show windows are prohibited.
54. Pendant cords ornamented with tissue paper or gauze.
55. Portable lamps, (a) motors, (b) fans, or (c) fixtures not connected through reinforced cord.
56. More than one cord in a rosette.
58. Pendant cords attached to circuits without approved fittings.
59. Unapproved coed adjusters.
60. Cord circuits.
63. Cord used for outside wiring not approved.
101. Wood cleats, staples or nails as insulators prohibited.
110. Cabinets not properly made (a) or lined.
111. No doors on cabinets.
112. Cabinet doors not lined
114. Cabinet inaccessible
120. Circuits overloaded.
130 Broken fittings.
131. Fittings loose from support.
134. No support provided for fittings.
140. Unapproved (a) or improper use of open link fuse blocks.
172. Service wire bushed with flexible tubing; must be porcelain or conduit.
174. Porcelain and flexible tubing out of place.
220 Low potential circuits not properly grounded on the direct current three-wire system, (a) alternating current secondary system.
225. Electric iron improperly installed.
230. Installation in such a hazardous condition that same should be completely rewired.
260. Joints not soldered, (a) or taped, (b) or properly made.
340. Outlets not in use should be thoroughly taped up.
391. Improper switch (a) or none at entrance point.
392. Entrance switch improperly located (a). or not readily accessible.
420. Lamp sockets not bushed.
421. ¼-inch sockets used on reinforced cord instead of ⅜-inch sockets.
490. Wires of opposite polarity in contact (a) or too close together.
492 Wires against or too close to grounded pipes, or improperly protected.
494 Wires not protected where liable to mechanical injury.
495 Wires in contact with outside awning (a) or with metal front or side of building.
497. Wires not bushed, (a) or bushed improperly through walls, floor or partitions.
500 Wires not attached rigidly in position, (a) or loose from support.
503. Wires not supported at sufficiently frequent intervals.
507 Service wires in bad shape or not properly attached to or insulated from building.
508. Wires in contact with other materials than insulators.
509. Unapproved wire.
512. Wires not properly supported over roofs
513. Wires in open work not properly spaced.
515. Bare wire.
516. Wires knobbed (a) or cleated over horizontal surfaces.
517. Dead circuits and wires should be removed.
520. Wires must enter cabinet through openings made for that purpose only.

Electrical Report of Bureau; Page 2 of Form K.

In addition to the above methods of combatting the fire loss, the surveyors of the rating bureaus inspect and reinspect all business buildings and special hazards within the various towns and cities and apply specific charges for any hazardous conditions they may note.

Various sections of the United States are divided into districts with a board or bureau over same, formed by the insurance companies operating in these sections, for the purpose of obtaining insurance rates on buildings and their contents. In Oregon this organization is known as the Undewriters' Equitable Rating Bureau. This is an association created and existing under the insurance laws of the state of Oregon.

In order to obtain safe conditions as regards electrical installations, this Bureau maintains an electrical department as part of their association.

In Portland, the electrical department endeavors to maintain supervision over all new electrical installations in all manner of installations except dwellings. Outside of the city of Portland, they have been making thorough inspections in all buildings except dwellings, in all the larger towns and cities in Oregon.

This inspection also includes the inspection of the booths in motion picture shows, motion film exchanges and storages and private and municipal fire alarm systems, throughout Oregon.

The methods pursued are the following:

(1) In new buildings in Portland the work is watched as it is installed and the electrical contractor or owner is notified if the same is not being installed according to the N. E. C. rules and requirements. If after exhausting all means the Bureau fails to get the proper installation the only recourse they have is to make a change in the insurance rate on the building.

It is seldom necessary to resort to this increase in rate, as nearly all architects will aid the Bureau in getting the proper installation. Also nearly all specifications written by architects require the electrical contractor to obtain a written certificate of inspection from the Underwriters before final payment is made to the electrical contractor.

Your "special attention" is called to the defective installations in the following risks, previous readjustment of rates had been made:

WEST SIDE OF MAIN STREET

Party Responsible	Class	Index	Blk.	Sh.	Page	Rating	Defects
Chinese laundry 313	D	5	2	20	12	14	.....230.
Leonard Charman . ..407-411	B	11	3	16	13	7	.....Electric Hotel office: Passable. Second floor: 60. Third floor: 60. Drug store: 172, 392a, 508.
E. A. Grady 413-415	B	12	3	16	13	11	.....Restaurant: 56, 60. Barber shop: 172, 509. Confectionery: 230. Saloon: 55, 497, 508. Second floor: Passable.
G. A. Harding....NW cor 5th	D	17	4	16	14	2	.....60, 101, 430, 508, 517.
G. A. Harding 503	D	18	4	16	14	4	.....10.
County C'thouse..NW cor 8th	D	41	7	10	16	17	.....392a.

EAST SIDE OF MAIN STREET

Joseph Supple .....,.....	D	58	27	16	5	9	.....225.
Frank Jagger.....NE cor 7th	D	75	24	10	7	12	.....Restaurant: 51, 55, 497. Second floor night sign: 60. Meat market: 55. Cigars: 60, 392a.
Chinese laundry 312	D	50	28	20	4	8	. ..230.
....	D	74	24	10	10	7	.....No inspection; locked.

Defective installations were found to exist in the following risks, and the owners have been advised:

WEST SIDE OF MAIN STREET

Party Responsible	Class	Index	Blk.	Sh.	Page	Rating	Defects.
Oregon City Mfg. Co. Bet 3rd and 4th Sts		1	231	20	11	16	.....Office: 60. Storage: 61, 51a, 55, 59, 497. Warping: 55, 431. Weaving: 430, 431, 493, 500a, 509. Basement: 55, 130, 131, 340, 431, 480. Second floor: 1, 55a, 508.
Oregon City Laundry NW cor.3rd	D	2	2	20	12	2	.....55, 392a.
Burmaister & Andus.....317	D	6	2	20	12	16	.....Restaurant: 51a, 55b, 56, 60, 392a.
Wm. Andresen 319	D	7	2	20	12	18	.....Tailor: 52, 392.
Gambrinus B. Co..SW cor 4th	B	8	2	20	12	20	.....Saloon: 58, 60, 101. Second floor: Passable.
Pope & Co.....NW cor 4th	B	9	3	16	13	2	.....Hardware: Passable. Second floor: 391, 494, 517.
John Tobin . . ....:.403	D	10	3	16	13	4	.... .Confectionery: 55, 60. Second floor: 110a. Third floor: 140a.
W. A. Dimmick 419	D	13	3	16	13	17	.....58, 60, 392a, 495.
W. A. Dimmick...SW cor 5th	D	15	3	16	13	21	.....55, 58, 172, 430, 508.
Geo. A. Harding.....505	D	19	4	16	14	6	.....52, 60.
Geo. A Harding.....507-511	B	20	4	16	14	8-9	.....Curio store: 51, 55, 392. Feed store: 60, 392a. Drug store: 11.
Kelley Estate 517	D	22	4	16	14	14	.....Confectionery: 55a. Second floor: Passable.
Kelley Estate 519	D	23	4	16	14	16	.....Bakery: 392a.
Portland Ry. L. & P. Co..617	D	32	6	16	15	13	.....120.
Wm. Andresen....SW cor 7th	B	33	5	16	15	15	. ..Jewelry: 114 Saloon: 60, 112. Drug store: 55, 56, 60, 392a. Second floor: 112. Basement: 61, 509. Second floor: Passable.
Richard Petzold 703	D	35	6	10	15	23	.....Barber shop. 121. Restaurant: Passable.
Hon. Thomas Ryan.....707	B	36	6	10	15	25-26	.....Com. Club: 55b, 112. Basemt: 55, 60.
Canfield Bros.	B	37	6	10	16	2	.....Drug store: 60, 392a. Paint department: 392e.
E. G. Canfield	B	38	6	10	16	4	.....Jeweler: 56, 60. Second floor: 11.
E. G. Canfield	D	39	6	10	16	9	.....Undertaking: 11.
J. E. Armstrong 813-815	D	42	7	10	16	22	.....Millinery: 226. Plumbing: Disconnected.
J. E. Armstrong..SW cor 9th	D	43	7	10	16	24	.....Restaurant: 54. 2nd floor: Passable.
J. B. Fairclough.NW cor 10th	D	45	9	6	17	13	.....51, 55, 60.

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WEST SIDE OF MAIN STREET—Cont'd

Party Responsible	Class	Index	Blk.	Sh.	Page	Rating	Defects
Frank Busch....NW cor 11th		47	10	6	18	6	.....General store: 60. Basement: 58. Second floor: 58. Busch's Hall: 112. Balcony post lights: 230

EAST SIDE OF MAIN STREET

Miller & Williams 308	D	49	28	20	4	5-6	.....391a, 507.
Roy Clark 320	D	51	28	20	4	14	.....55, 60, 497.
P. G. Anderson 414	D	57	27	16	5	7	.....Barber shop: 60. 2nd floor: Passable
Roswell Holman 422	D	59	27	16	5	10	.....Second floor: 10. Saloon: Passable.
Geo. C. Harding...NE cor 5th	B	61	26	16	5	20	.....Barber shop: 60. Furnishings: 52, 392, 497.
C. D. & D. C. Latourette.....	B	62	26	16	6	2-3	.....Shoe store: 60, 430.
Gambrinus Br. Co.....524	D	66	26	16	6	18-19	.....Hardware: 51a, 56, 60, 112. Poolroom: 51.
Gambrinus B. Co .SE cor 6th	D	67	26	16	6	18	.....Hotel: 56, 60, 112. Second floor: Passable.
Williams Bros. 612	D	71	25	16	7	3	.....Barber shop: 60. Real estate and second floor: Passable.
Oregon City	D	76	24	10	7	14-15-16	.....Engine house: 60.
Frank Jagger 714	B	77	24	10	7	18	.....Cigars: 60. Saloon: 60.
Weinhard Br. Co..NE cor 8th	B	82	23	10	8	2-3-4	.....Printing: 55, 497. 2nd flr: 10, 515. Grocery: Passable
M. J. F. Hodge.....		88	20	6	9	11-12	.....Stable: 507.
F. Griessen....East on 6th St	D.	68.	26	16	8	20	.....Hotel: 112.

WEST ON SIXTH FROM MAIN STREET

Bank of Oregon City.....	IC	28	—	16	—	6	...174.

Defective installations have been corrected and made satisfactory in the following risks, of which the owners had been previously notified:

WEST SIDE OF MAIN STREET

Party Responsible	Class	Index	Blk.	Sh.	Page	Rating	Defects
Bank of Oregon City.....609	B	27	5	16	15	2	.....Rear shop: 51a, 55, 68, 60, 134, 260, 508.
Bank of Oregon City.....613	D	29	5	16	15	9-10	.... Grocery: 52, 60. Printing: 55, 60
F. Jagger 612	D	30	5	16	15	8-10	.... Ten-cent store: 55
E. G. Canfield....SW cor 8th	D	40	6	10	16	11	52
McLaughlin Inst.	D	44	8	10	17	5	.....School: 112.
Oregon Com. Co..SW cor 11th	D	46	9	6	17	25	.....52, 60, 110, 430, 516, 520

EAST SIDE OF MAIN STREET

C. D. & D. C. Latourette..512	B	63	26	16	6	5	. . Bank: 60.
Frank Jagger 514	D	64	26	16	6	9	.. Second-hand: 58, 260a, 392, 430, 503
H. Stevens..... NE cor 6th	D	69	25	16	6	24	.....Dry goods: 65, 60. Cigar store: 60 Second floor: 112.
Howell & Stevens SE cor 7th	D	72	25	16	7	5-7	. . Department store: 55, 60. Basement: 112, 235.
First M. E. Church. . .	D	73	25	16	7	5-7	. W. C. W. hall: 392a Sign: 60, 63 Second floor: 130.
Mrs. E. Knapp NE cor 10th	Ven	86	22	10	8	22	. . Adams Dept. Store Passable First floor: 56, 58, 60, 111 Second floor: Passable.

SOUTH SIDE OF ELEVENTH STREET

Clerk School Board SE cor Harrison	D	91	426	13	27	8	.. ..55, 60

EAST SIDE OF WATER STREET

B. P. O. E.	D	92	6	16	29	16	.... Basement. 58. Lodge 120 Piano and desk 60.

Moving picture machines are improperly rates had been previously readjusted installed in the following risks, in which the

Party Responsible	Class	Index	Blk.	Sh.	Page	Rating	Defects
Charles Schram	D	24	4	16	14	17	.... Booth not standard.
Geo. A. Harding	E	61	26	16	5	20	.....Booth not standard.
W. A. Long.....	D	79a	24	10	7	25	. .Booth not standard.

Portland, Oregon, February 20, 1914

Jas. N. McCune, Secretary

Electrical Report of Bureau; Page 4 of Form K.

(2) Outside the city of Portland there exists a different condition and it is impossible for the Bureau to supervise the new work due to the expense necessary to have enough inspectors to cover the field, Therefore, the Bureau endeavors to get all the local electrical ordinances passed which is possible, based upon the rules and requirements of the National Electrical Code, and have the fire chiefs, city engineer or any competent available person appointed as the inspector.

The following towns now have ordinances and inspection by local inspection departments: Hillsboro, Ashland, Medford, Grants Pass, Albany, Salem, Astoria, Eugene, Roseburg, Marshfield, Klamath Falls, Portland, Dallas, Independence, Sheridan.

[To be continued.]

CALIFORNIA ASSOCIATION OF ELECTRICAL INSPECTORS

Section of N. A. E. I.

C. W. Mitchell, President. Arthur Kempston.
Wm. G. Pennycook, Vice-Pres. B. C. Hill, Executive Comm.
John W. Carrell Secretary-Treasurer, 55 Fulton, San Francisco.

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correllate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

By the Secretary.

The regular meeting of the C. A. E. I. was held in City Hall Annex, Oakland, on April 18th. The assembling of the inspectors brought forth many expressions of agreeable surprise regarding the growth, the changed skyline and the apparent prosperity of the city on the east side of San Francisco Bay. My, what a place to inspect!

George R. Babcock assisted Chief Inspector B. C. Hill in welcoming the members. In a few well-timed remarks he pointed out the larger feasibility of covering the moderate rather than the extreme case, when arranging or interpreting rules of construction.

The session was called to order at 2 o'clock by Vice-president Pennycook. The topic, "Main Service Wiring" was discussed until 4:30. A detailed account of this discussion will appear in a future issue of the Journal

After adjournment many of the members accompanied Mr. Hill to the Central Fire Alarm Station where well appointed quarters and an up-to-date system were found. One significant comment during the visit was on the passing of the electric horse-let-loose and the coming in of the automobile starter set in motion from the central fire alarm station.

Questions and Answers.

Ques. 1. A wooden cabinet is installed for ten lighting circuits eight of which are run knob and tube, and the other circuits and the feeders in conduit. Will this pass inspection?

Ans. 1. Yes, if condulets are used on conduit.

Ans. 2. No. Rule 26 (t) and 70 (b) require a metal cabinet.

Ans. 3. Sorry, but would be forced to pass is conduit was tied together and to ground and provided with proper terminals.

Ans. 4. No. Rule 26 (t) covers this.

Ans. 5. Yes. Would require condulets in cabinets.

Ans. 6. Yes, but would require a proper fitting on end of each conduit. See Rule 28 (d).

Ans. 7. Yes, if bonded, grounded and equipped with terminal fittings. Rules 23 (t), 70 (b), 28 (d).

Ans. 8. No. Not unless conduits were equipped with fittings of condulet type, were tied together and grounded.

Ans. 9. Should say that this was a conduit system because the feeders are in conduit.

Ans. 10. Yes, if Rule 28 (d) is complied with. This rule provides for special permission in such cases. Who says the Code is not consistent?

Ques. 2. According to Rule 83 (b) regarding compartments to enclose cutouts, does sign body which forms a completely enclosed and weatherproof compartment fulfill this requirement? If not, must the compartment be removed from the sign body or may it be constructed within same?

Ans. 1. Code Rule 83 (b) is very clear on that point. A separate compartment must be provided and may be placed either inside or on the outside of the sign body. The sign body may form a portion of the body of the cabinet for the cutouts.

Ans. 2. No, compartment must be separated from the rest of the sign body, but may be a portion of it.

Ans. 3. Must have separate compartment.

Ans. 4. Yes.

Ans. 5. No. Should be separate compartment, but may be in sign.

Ans. 6. Yes, but not in a vertical sign if the cutouts were placed at the bottom. A considerable draft exists in this kind of sign and a fire starting at a loose terminal communicated to the rubber would follow up inside very rapidly. Would consider a separate compartment either in or out of the sign body as the best practice.

Ans. 7. Rule 83 (b) requires a separate compartment in or out of sign.

Ans. 8. Would require a separate housing in sign.

Ans. 9. Rule 83 (b) states clearly a separate compartment, meaning completely removed from sign.

Ans. 10. No. Separate completely enclosed compartment either in or out of body.

Ques. 3. Rule 23 (d) paragraph 2-3. Do you interpret this to limit the number of receptacles per circuit for signs to thirty-two?

Ans, 1, 4, 7 and 8. No.

Ans. 2. No, but good practice endorses a rule limiting the number of outlets per circuit.

Ans. 3, 5, 9 and 10. Yes.

Ans. 6. It would seem to me that Rule 23 (d) paragraph No. 3, is there to provide for low voltage systems. For instance, 10 watt lamps on a 12 volt system. In this case each lamp would require 1.2 amp. and as 20 amperes is the maximum fuse allowed the number of lamps per circuit would be limited to 17. I would say that the lamps per circuit should not exceed 32.

AN INSPECTION LEGAL RULING.

The department of electricity of San Francisco has been advised by the city attorney that it is correct in claiming that it must approve the plans and specifications for electric work in buildings and authorize the work to be done before it can be begun. The department informed the city attorney that a certain corporation claimed that it could do such work without previous authorization, and that when completed it could file plans of the work and correct whatever part of it did not comply with the law, on being notified to do so by the department inspectors. To permit such a practice as this would be dangerous, the department stated, and the city attorney says that any one guilty of it can be prosecuted, as it is a violation of the ordinance governing electric wiring and installations.

Alaska water power resources on the Seward Peninsula favorably situated for development have been estimated by H. H. Henshaw of the U. S. Geological Survey to be between 30,000 and 40,000 h.p.

INDUSTRIAL GAS CALORIMETRY.

For many years all laws and regulations relating to manufactured gas were based on candlepower requirements, i.e., the gas burned in a definite burner at the rate of five cubic feet per hour was required to give a specified illumination of so many candlepower. This specification furnished a perfectly satisfactory control of the quality of gas delivered so long as the gas was chiefly used for illuminating purposes with the old style of open-flame gas burner. At the present time, however, this inefficient type of burner has been very largely displaced by burners of the Welsbach mantle type. Furthermore, a large amount of the gas sold today is used for cooking purposes and to some extent for operating small gas engines for power purposes. In these applications of gas it is the heating value that is of first importance and not the candlepower. It has been estimated that less than 20 per cent of the gas manufactured and sold today, indeed in many of our cities and towns less than 10 per cent, is used in the old type of open-flame gas burners. Notwithstanding this fact we still find in most of our cities and towns ordinances on the statute books requiring that the gas meet a definite candlepower test, while no attention has been given to the question of heating value, which is the important factor for over 80 per cent of the gas sold. Many of the candlepower requirements fixed by law are quite high, often requiring the manufacture of an expensive oil-enriched gas, which may not be the most economical gas to the public. The importance of the heating value of the gas is now being quite generally recognized, and where new legislation has been adopted recently and where public service commissions have considered the question of gas regulation and have gotten to the point of issuing regulations, the heating value standard is being generally adopted, supplemented in some cases by a moderate candlepower standard, the latter with a view to affording the necessary protection to those who still use the open-flame burner.

Electrical standardization in China is engaging the attention of the Engineering Association of China, having headquarters at Shanghai. It is proving a rather difficult undertaking because of the great variety of supplies now shipped into China from various parts of the world. It is recognized, however, that far-reaching benefits would result from the proposed standardization, and as a result the consuming public is encouraging the movement. The officers and directors of the Engineering Association of China are as follows: J. S. S. Cooper, chairman; R. A. Williams, secretary; T. H. U. Aldridge, H. H. Arnold, N. G. Beale, J. E. Burgess, L. Junginger, E. Kocher, L. Laforest, and S. S. Sellick. In case it is possible to bring about the desired standardization the following advantages would be secured: (1) Buyers of electrical plant will receive tenders on a comparable basis; (2) the possibility in interconnecting different systems and the consequent use of large bulk supplies, which is almost impossible in many of the larger European cities; (3) minimizing the variety of electrical stock, such as lamps, meters, motors, transformers, and general supplies, kept at the trading centers; (4) the interchangeability of consumers' appliances.

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Combination—Co-operation—Competion

These three: Combination, co-operation and competition. None is greatest. Each is necessary and has its place. First, a joining together for a common purpose, then an operating together in the extension of markets and the furthering of mutual interests and finally a continued operation stimulated by sane competition.

Combination makes for solidarity, and is conducive to efficiency. Introduces strength into craft or industry. Blends into one perfect whole and so binds with the cords of a common purpose that all interested act as a unit.

The effects which follow are the result only of co-operation. Joint operation in achievement. The power and purpose of the Jovian Order makes possible a high order of co-operation. "All-together all the time for everything electrical."

First the wide membership rapidly embracing each individual in the electrical industry, and then the accomplishment of the purpose of the organization through co-operative effort. A working together to popularize the product and so further the interests of the individual and the industry.

The existence of the two Jovian Orders is inconceivable, and equally so one nation-wide electrical dealer, jobber or contractor. Competition in the carrying out of the purpose is essential. Not cut-throat competition, but that which recognizes the necessity even there, for team work.

The idea should be, get the business by any method which squares with, but by none opposed to the principle which has called the Order into existence, namely—mutuality in the realization of a common purpose.

Combination, co-operation and competition, these three then, constitute the life of trade today.

Life is that which stimulates, and galvanizes the inert into intelligent action.

To abolish the competitive system entirely is to automatically introduce socialism.

In an ideal state in which the undesirable qualities of humans have been eliminated, socialism with its implied principle of associated and correlated effort applied to everything would indeed prove a desirable equalizer of the business load carried by each.

But the condition which confronts the people of today is a real condition with all the limitations implied; the individual apathy, indolence, inability, ignorance, rapacity and greed; the selfishness and cunning of the weak; the domination and oppression of the strong.

Socialism is an ideal state possible only in an ideal community. It may be said to be eons distant.

Such extreme co-operation would strive to share equally the benefits of invention and make monopoly an efficient means of distribution that maximum benefit be derived by all.

But invention with its efficiency and progress is impossible without incentive. Lack of incentive is inertness, and inertness, death.

Co-operation eliminating competition would prove a hastening of industrial death.

The Inertia of a Name

"What's in a name?" wrote Shakespeare and while his implied reply of "Nothing," might be applicable in that particular instance, yet a name is a word, and as such conveys all the meaning that the use of the word implies. So that if a thing is called by the wrong name the wrong impression created will continue indefinitely—all according to the physical law of inertia.

As supplementing Mr. H. S. Cooper's discussion, which appeared in a recent issue, it is of interest to note that the principles advocated by Mr. Commissioner Thelen in his paper on the determination of a scientific basis for rate-making, no longer represent the opinions of an individual but have been accepted by other members of the California Railroad Commission and used as a basis for recent decisions.

It is inconceivable that the commissioner should have intended the relationship of principal and agent to be considered as applying to all utilities and to every condition, though this is the generally accepted idea.

But whether the relationship is that of Principal and Agent, a Partnership, or some other, and while some may consider that the utility is entitled only to a return upon capital judiciously invested, agreement with this departure from generally accepted business principles which prevent a utility enjoying with other corporations a return upon the so-called unearned increment, will not form a sufficient basis upon which to establish the fundamental relationship which does exist.

It would appear that Mr. Commissioner Thelen has drawn much of his inspiration from the decision of Judge Van Fleet in the case of San Diego Water Company vs. San Diego, 118 Cal. 556, where, at page 570, the idea is expressed that the utility is only the agent of the public to administer the use of certain public properties contributed or acquired.

Much might be said for and against such an attitude as applying to all public utilities. But one fact stands out prominently. This word "agent" used by Judge Van Fleet does not mean that there is necessarily a correlated "principal." The use of the word "agent" does not therefore infer that the public is the principal but rather the "owner" of some, or apparently in that case all, of the properties used. The public might as readily be termed the silent partner and the utility the agent—the active partner.

The legal meaning of "agent" as interpreted from the old English law of "principal and agent" is not the same as the general physical meaning of the word. An "agent" may be one who acts or has power to act. This without reference to a power from which authority to act is derived.

In this way we may consider the utility as the agent; the means; "the active power or efficient cause" according to the Standard dictionary, of the service rendered to the public, and it appears equally probable that this is the sense in which the term "agent" was used by Judge Van Fleet in his much quoted San Diego decision.

"What's in a name?"

Much of discussion if it has a dual meaning and perhaps much of harm if wrongly interpreted.

But by whatever name commercial utilities may be called, there is no question but that their service has continued to improve, while at the same time government statistics offer the unquestionable proof, that no matter what their rate-making basis actually is, their charges (rates) continue consistently their revision, downward.

The Most Efficient Light

Man dominates all. Yet to the lesser lights of creation he still turns, as he has done always, for inspiration and information. This life and intelligence, though inferior to that of mankind, still holds secrets which insistently challenge investigation. They remain unanswered.

Ant activities for example, have called forth admiration since before the days of Solomon and have proved the example and incentive of the sluggard's turning toward industry.

The perseverance of the spider was both annoyance and inspiration long before a Bruce admitted the source of his renewed activities resulting in achievement, while to the bee, man must always turn for his highest lessons in co-operation and devotion to duty.

To all of these he has turned for the foundation of his most admirable feats of construction engineering though the greater accuracy of the work of the lower organisms still induces admiration and awe.

At the Panama Pacific International Exposition, 1915, the recently developed nitrogen filled lamp, with its remarkable efficiency of .6 watts per candle, will be used for special lighting effects.

But light will also be used there which will have ten times the efficiency of the latest production of the lamp factories, for throughout the restful moon-lit setting of the Palace of Fine Arts, no light will be visible save the flash of an occasional firefly among the foliage.

The fire-fly emits light at an efficiency which baffles man's duplication, being somewhere in the neighborhood of 0.054 watts per candle; practically all the energy expended being used for light production within the range of the visible spectrum.

As a constant light source the light of the fire-fly and other lower organisms would be far from satisfactory. It has been described as having been carried too far for human needs. Its color being of course undesirable as it ranges from yellow to bluish green.

Even though you destroy these little generators of such magnificent parts, and their product is still available it may years afterward, be made to produce light.

Born of an intense interest in this subject—the production of light by living organisms—Mr. F. Alex. McDermott has just given these and other fire-fly facts in a paper presented before the Illuminating Engineering Society.

Mr. McDermott states that because of his investigations he has "been accused of intending to run the electric lamp makers and illuminating gas manufacturers out of business." But though the possibilities are vast, the conclusion is that "the production of artificial fire-fly light will not interfere with present methods of illumination—at least, not for a long time to come."

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

F. V. McAvoy of the Reno Electric Works, Reno, Nevada, was a recent Sacramento visitor.

H. F. Yost, representative of the Electric Appliance Company in Nevada, is at San Francisco.

P. D. Callahan, representing Faries Manufacturing Company, Decatur, Ill., is at San Francisco.

C. A. Conry, representing "The Electric Garage," Sacramento, Cal., was a San Francisco visitor last week.

R. St. John is now connected with the Edison Lamp Works of General Electric Company at San Francisco.

F. A. Walker, electric department manager of Weinstock, Lubin Company, Sacramento, was at San Francisco recently.

"**A. E. Morphy,** assistant secretary Southern California Edison Company of Los Angeles, will summer in Santa Monica."

Van E. Britton, gas engineer, announces the removal of his offices to rooms 304-307, 454 California street, San Francisco.

A. Cherrill of the firm of Rankin & Cherrill, electrical contractors and dealers, has returned to Vancouver, B. C., from Southern Cailfornia.

Fred F. Skeel, sales manager, Crouse-Hinds Company, Chicago, Ill., is at San Francisco, having just completed an extended business trip throughout Southern California.

Nick Cooper, salesman with Westinghouse Electric & Manufacturing Company, has just returned to San Francisco from a business trip through the southern part of California.

C. E. Roesch has been appointed Western representative of the Edward F. Caldwell Company, high class lighting fixtures, of New York, and has opened a studio and offices in the Shreve Building, San Francisco.

James B. Brokaw, Idaho Jovian Statesman, held a rejuvenation at Pocatello, April 18th. **A. E. Smith** and **A. L. Faber** and **H. E. Holland,** of Salt Lake City, and Reigning Mars **E. A. Wilcox,** of Twin Falls, assisted.

N. C. Cotabish, general sales manager National Carbon Company, Cleveland, Ohio; **H. E. Hackenberg,** secretary and treasurer, and **F. H. Murray,** local manager of the company at Los Angeels, Cal., are at San Francisco.

Chas. T. Phillips is consulting illuminating engineer on the lighting project for the Fourth Street Improvement Association, San Francisco. It is proposed to use about ninety one-light standards equipped with nitrogen-filled lamps.

H. W. Cope, assistant manager, Industrial & Power Department, Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., has arrived at San Francisco in order to make arrangements for the Westinghouse exhibit at the P. P. I. E.

Frank Cavenagh of New York has been appointed manager of the San Francisco office of the Metric Metal Works of the American Meter Company, manufacturers of the Tobey Cast Iron Gas Meters. Offices have been opened at 763 Mission street.

C. M. Brewer, manager Western States Gas & Electric Company, Richmond, Cal., has been appointed a member of the Factory Committee of the Richmond Industrial Commission which has laid plans for an aggressive campaign to locate new factories in Richmond this year.

F. H. Hughes, selling representative of the Rauch & Lang Carriage Company of Cleveland, Ohio, is in Salt Lake City, and will spend the next three or four months there working in conjunction with the Spiker Electric Garage Company, their local representatives.

Robt. Sibley has left for an extended trip to Honolulu, the ocean voyage being taken with a view to complete recovery of his health. The series of articles recently started by Mr. Sibley in this Journal cannot yet be continued. We wish him bon voyage and a speedy recovery.

W. L. Goodwin, general menager Pacific States Electric Company; **W. S. Berry,** local manager Western Electric Company, San Francisco, and **W. S. Hanbridge,** Secretary of the State of California Electrical Contractors' Association, are visiting Los Angeles on business in connection with the latter association.

John C Jones, Jovian Statesman, has planned for a rejuvenation at Salt Lake City, Tuesday, April 21st, at the close of the convention of the Utah Power and Light Company representatives. Several hustling committees are at work on the affair, and the rejuvenation promises to be one of the most highly successful ones held in the city.

Dr. Thos, Addison, Pacific Coast manager General Electric Company, presided at a conference of local managers of the company held at Del Monte during the past week. **T. E. Bibbins,** local manager, San Francisco; **J. A. Cranston,** local manager, Portland, Oregon; **R. J. Cash,** of Los Angeles, Cal.; **S. E. Kearny,** Pacific Coast auditor, and **W. J. Davis,** Pacific Coast engineer, were in attendance.

Alexander Dow, formerly president of the Detroit Edison Company, who has been in the West for some time doing some consulting work in connection with an irrigation system in Arizona, was in Los Angeles last week and while there addressed the Realty Board on "Municipal Ownership." He pointed out its many pitfalls and sounded a warning to the citizens of Los Angeles, who are now contemplating the building and operation of a municipal power plant.

R. Roy Cowles was elected an Associate Member American Institute of Electrical Engineers at the directors' meeting held at New York, March 13, 1914. Others elected associates at that time and residents in the West, were: **Arthur H. Demock,** city engineer city hall, Seattle, Wash.; **Frank H. Klippel,** meter tester, Nevada-California Power Company, Tonopah, Nev.; **Russell B. Munroe,** electrician, Phoenix Construction Company, Provo, Utah; **W. L. Newton,** Throop College of Technology, Pasadena, Cal., and **Claude R. Shaw,** of the Northern California Power Company, Manton, Cal.

R. H. Sperling, who was general manager of the British Columbia Electric Railway Company, Ltd., operating on Vancouver Island and the mainland of British Columbia, has been promoted to the position of assistant executive to the chairman of the board of directors at the London offices of the company. Mr. Sperling, though a very young man, has successfully piloted the company through its most trying period of expansion, notwithstanding all the deterrent political influences involved. He has always been prominent in educational and welfare work in the interests of employes and it is noteworthy that throughout his administration there has been no cessation of the company's service due to labor troubles. Rather the policy of the management acted as a stabilizer to the labor situation in the territory served.

Chas. H. Lee has heen appointed by the Treasury Department as consulting engineer to advise with the United States Public Health Service regarding a water supply at the large tubercular sanatorium maintained by the government at Fort Stanton, New Mexico. The sanatorium has in the past diverted water from Rio Bonito for domestic and irrigation purposes, and is now involved with other water users in an adjudication of water rights as provided for under the state water laws. The adjudication has been initiated as a result of the diversion of water from the drainage area by the El Paso & Southwestern Railroad for locomotive and train use. The railroad has spent over a million and a half of dollars in developing and transmitting mountain water along its line, and in so doing has seriously affected the sanatorium supply. Mr. Lee has just returned from a three weeks' trip to Fort Stanton and on the way back stopped several days in Denver and attended the irrigation conference called by Secretary Lane.

MEETING NOTICES.

San Francisco Electrical Development and Jovian League.

The league met at a downtown cafe last Tuesday and after luncheon enjoyed a series of moving pictures shown by E. H. Kemp, of the Gamboa Dyke operations on the Panama Canal and of the Grand Canyon of Arizona. Mr. Kemp made many interesting comments on the pictures. W. F. Neiman, president of the league occupied the chair.

Seattle Section A. I. E. E.

The April meeting of the Seattle Section was held in the assembly room of the Chamber of Commerce on the top floor of the Central Building, on Tuesday evening, April 21st. Robert Howes presented a paper entitled "Engineering Ethics," which was followed by several prepared discussions of the above paper, together with a consideration of the more general topic, "The Relation of the Engineer to the Civic and Social Problems of the Day." Important matters of business also came before the Section at this meeting, which was well attended.

Illuminating Engineering Society.

The executive council at a recent meeting held at New York expressed an opinion to the effect that they at that time deemed it inexpedient to hold the 1915 Convention in San Francisco. With the rapidly growing interest in this Society here, there should be no reason why this opinion should not be reversed in the minds of the members of the incoming administration. The statement of the present council which has been spread upon the minutes of the I. E. S., should stimulate Pacific Coast members both in their quest for new members and in the formation of one or more Pacific Coast Sections.

Utah Society of Engineers.

The annual banquet and meeting of the Utah Society of Engineers was held at the Hotel Utah Friday evening, April 17th. Ledyard M. Bailey was toastmaster and addresses were made by A. S. Peters, chief engineer of the Mountain States Telephone and Telegraph Company, retiring president; W. W. Armstrong, president of the National Copper Bank; W. J. Barrett, president of the School Board; and John C. Howard, president of the Utah Oil Refining Company.

Following the banquet, the annual election of officers was held. Sylvester Q. Cannon, city engineer, Salt Lake City, was elected president. The other officers chosen were: Samuel S. Arentz, chief engineer of the Interurban Construction Company, vice-president; Frank W. Moore, architect, secretary; L. H. Jones, city engineer's staff, treasurer.

Electrical Section Nevada Industrial Safety Association.

The program of the meeting of Electrical Section, Nevada Industrial Safety Association, held at the Electrical Building, University of Nevada, at 2 p. m. on April 18th, was as follows:

1—Proper Voltage for Underground Mine Operations. F. B. Mechling, manager Nevada-California Power Company.
2—Methods and Safety in Underground Electric Haulage. R. E. Middagh, electrical engineer, Steptoe Valley Smelting & Mining Company.
3—Possibilities in Underground Single-Phase Traction. T. R. Landsborough, chief electrician, Tonopah Extension Mining Company.
4—Handling Storage Battery Locomotives Underground. F. O. Broili, electrical engineer, Elko-Lamoille Power Company.
5—Lightning Protection for Mine Installations. H. D. Brown, superintendent, Truckee River General Electric Company.
6—Commercial Features in Safeguarding Electric Mine Installations. G. B. Burnham, General Electric Company.
7.—Handling High Voltages, Underground. G. L. Perrin, chief electrician, Nevada Hills Mining Company.
8—Operation of Electric Shovels. Joseph Beane, electrical superintendent U. S. R. S. Truckee-Carson Project.

These papers will be printed in full in an early issue of the Journal.

Utah Electric Club.

At the regular weekly luncheon of the Utah Electric Club held at the Commercial Club Thursday, April 16th, Judge C. S. Varian, a prominent attorney of Salt Lake City, read an able paper prepared by him especially for the club on the Panama Canal Tolls Question. Judge Varian traced the history of negotiations from the time that an isthmian canal was first considered down to the present day. He quoted copiously from Presidential messages, state department papers and treaties, which indicated clearly that it had been the intention of the United States Government long before they themselves considered the propcsition of building a canal to so arrange matters that by whomever the canal was built that it should be maintained and operated in an entirely neutral manner and that it should be open to the ships of all nations, the United States not excepted, for the purpose of commerce and navigation under substantially the same conditions as the open sea. He maintained very strongly that both by treaty and my moral obligations, the United States should not exempt clear coastwise vessels from tolls.

Jovian Electrical League of Southern California.

A very timely and helpful talk on "City Planning" was given before the League at the weekly luncheon held at Christopher's, Los Angeles, on April 15th, by J. S. Lathrope, the well-known city planning expert of New York City, in charge of the city planning exhibition now being shown in the city of Los Angeles. Mr. Lathrope is a serious and practical worker and is strongly advocating the establishment of a city planning commission in Los Angeles.

The meeting was attended by nearly 100 Jovians and a splendid whistling exhibition was given by Miss Stafford. Many visitors were introduced and it was announced by Chairman Colkitt that a rejuvenation will take place about the middle of May. Prizes, in the form of Jovian jewelry, will be given to the members securing the largest number of candidates. The meeting was presided over by A. G. Drake.

About 350 Jovians and their friends attended a very enjoyable theater party at the Orpheum on the evening of April 16th and their appreciation of the charms of Fritzi Scheff was attested by the presentation of a large bouquet of American Beauties to "the little devil of the opera."

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The commission has rendered a decision in which it finds that the agreement entered into July 13, 1912, between the Northern Electric Railway Company and the Sacramento & Woodland Railroad Company, by the terms of which the Northern Electric Company was granted the right to operate the Sacramento & Woodland line over the right of way of the Sacramento & Woodland and the Vallejo & Northern Railroad Companies between Sacramento and the city of Woodland, is void, because not authorized by the commission.

The commission has rendered a decision in which it denies the application of the Sawtelle Water Company, operating at Sawtelle, Los Angeles county, to issue $25,000 in 5 per cent thirty years bonds. As an alternative the commission grants authority to the company to issue notes in the sum of $10,500 for the purpose of making additions and betterments to its plant and system in the territory contiguous to the city of Sawtelle.

The commission has rendered a decision granting authority to the Pacific Telephone & Telegraph Company to surrender its franchise in Oakland and to take over and operate under the franchise of the Bay Cities Telephone Company, which the Pacific Telephone & Telegraph Company purchased in 1912.

The commission has rendered a decision authorizing the Los Angeles & San Diego Beach Railway to issue refunding promissory notes in the sum of $15,000 bearing interest at the rate of 6 per cent and a second promissory note in the sum of $19,000, bearing interest at the rate of 4 per cent, both due in four months. The notes are to be sold at their face value.

INTERNATIONAL ENGINEERING CONGRESS, 1915.

The attention of the engineers of the world is being more and more drawn to the program of the International Engineering Congress which is to be held in San Francisco, California, in 1915. The interest which has been aroused in foreign countries is shown by the fact that at the present time there have been received enrollments and subscriptions from 42 such countries. Of the present total enrollment, approximately 25 per cent is from the countries other than the United States. The number of subscriptions from the members of the five national engineering societies of the United States under whose auspices and control the Congress is being held is, however, not so gratifying. The percentage of the total membership of these five societies represented by the subscription list is only 3.7, and this, although each individual member of these societies has received circular information and data concerning the Congress and has been urged to send in his subscription promptly. This, to a considerable degree, handicaps the work of the Committee on Management, and it is extremely desirable that as many as possible who intend to subscribe should do so at an early date.

The list of topics to be treated in the Section on Mechanical Engineering gives a very good idea of the character of the publications which it is intended to issue and the topics which will be presented and discussed at the meeting. These are as follows:

Recent progress and present status of foundry practice, and casting metals; recent progress and present status of the art of forging; equipment processes, and methods for the boiler-shop; machine-shop equipment, methods, and processes; automatics; special processes for shaping and forming metals; high temperature flames in metal-working; industrial management; safety engineering; industrial museums as an educational factor; the steam-engine of the year 1915; the steam-turbine of the year 1915; the internal-combustion engine of the year 1915; motors of the Diesel type; the Humphreys gas pump; the steam boiler of the year 1915; refrigeration; pneumatics; lubrication and lubricants; water wheels of pressure type; water wheels of impulse type; hydraulic power developments and use; power-plant design; motor vehicles, passenger type; motor vehicles, utility type; motor tractors.

Many of these topics will be treated as symposiums with contributions representing the practice in more than one country.

The various sections outlined for the work of the Congress and the volumes to be issued are as follows:

Vol. I.	The Panama Canal.
Vol. II.	Waterways and Irrigation.
Vol. III.	Municipal Engineering.
Vol. IV.	Railways and Railway Engineering.
Vol. V.	Materials of Engineering Construction.
Vol. VI.	Mechanical Engineering.
Vol. VII.	Electrical and Mechanical Engineering.
Vol. VIII.	Mining Engineering and Metallurgy.
Vol. IX.	Naval Architecture and Marine Engineering.
Vol. X.	Military Engineering, and Miscellaneous.

The proceedings of the Section on Mechanical Engineering will be published in Vol. VI, with some of the papers falling into Vol. VII. It is also noted that Vol. X will consist only in part of Military Engineering and will also contain papers on miscellaneous topics which are not definitely associated with any of the various sections.

Full information concerning the Congress may be obtained by addressing the Committee of Management at the Foxcroft Building, San Francisco.

PEDDLERS WIN BALL GAME.

What might be termed an errorless game was witnessed by an enthusiastic crowd of fans electrical (don't put the reverse English on this) at the Ocean Shore grounds, San Francisco, last Saturday, when the Peddlers beat the Pawnbrokers by a score of 7-4. This was the first game of a series, the rest of which you should see. The line-up was as follows:

Peddlers.		Pawnbrokers.
Dunbar	Pitcher	Purcell
McGovern	Catcher	Carew
Pennoyer	1st Base	Hunt-Rose
Hammer-Fotreau	2d Base	Murphy
Valleau	3d Base	Vallejo
Vogalsang	Right Field	Williams
McCann	Center Field	Sullivan
Hauck	Left Field	Mahoney-Dazy
Francisco	Short Stop	Swan

NEW CATALOGUES.

The 1914 Hubbard Reference Book on pole line construction is being distributed from the Pacific Coast office of Hubbard & Company at 693 Mission street, San Francisco. This text illustrates and describes various methods of line construction giving many practical suggestions and new ideas on the subject.

TRADE NOTES.

The Haliday Machinery Company recently furnished the city of Seattle with a Ridgeway motor generator of 500 kw. capacity, at a cost of $7310.

Westinghouse Electric & Manufacturing Company recently sold one 2500 k.v.a. water wheel type generator to the Truckee River General Electric Company.

On account of the rapidly approaching completion of the Big Creek project the Fresno, Cal., office of the Stone & Webster Construction Company will be closed May 1st.

The Puget Sound Flour Mills of Tacoma has recently contracted with the Puget Sound Traction, Light & Power Company of Seattle for current to the extent of 800 h.p.

The Electric Appliance Company secured the order for lighting fixtures and Nuholux reflectors for the new office building of the United Verde Copper Company, Jerome, Ariz.

The Board of Public Works of Seattle recently placed orders for 6000 watt-hour meters. The order was divided between the Western Electric Company, the Fort Wayne Electric Company and the Northwestern Supply Company, at Seattle, Wash.

To illustrate the rapidity with which lodgepole pine is being recognized as a pole timber, the District Forester, San Francisco, states that a contract is now in effect whereby a large area of lodgepole pine on the Lassen National Forest is being sold to a company of local men. It is understood that this company will erect one or more creosoting plants and will place butt-treated poles on the market during the coming season.

The Utah Power and Light Company are calling a convention of all of their district and commercial representatives to be held in Salt Lake City April 20th and 21st. Regular matter pertaining to the company's business will be taken up and discussed during the four sessions of the conference. On Monday evening a banquet will be given by the company to its visiting representatives and some invited guests. Tuesday evening will be given over to the Jovian Rejuvenation, for which Statesman John C. Jones has arranged.

S. S. Bullis of New York City is promoter of the street car lines at Medford, Oregon, and is also doing extensive work at the Sterling mine located 14 miles south of Medford in the Siskiyou mountains. The 6600 volt a.c. generator brought from Jacksonville last fall has been installed three miles above the mine, where a 75 ft. head is available, and is direct connected to a Pelton turbine. The three-phase transmission line is No. 2 bare copper, three miles long, supplying power to a 300 h.p. motor direct connected to a centrifugal pump which will increase the water pressure to be used in the placer mining operations. The generator is an 850 k.v.a. Bullock machine. The motor generator set at Medford for the street car work consists of a 290 h.p. Westinghouse, three-phase, 2200 volt, synchronous motor, connected direct, to a Westinghouse, 200 kw., 600 volt d.c. generator, running at 900 r.p.m. The switchboard is of Westinghouse manufacture, two panels, one containing the a.c. ammeter, power-factor meter, exciter ammeter and switch lever for the 2200 volt oil switch controlling the motor. The other panel contains the d.c. line switch, voltmeter and ammeter, etc. They are operating one car from Main and Central avenue, to Siskiyou Heights. It is a St. Louis Car Company car, pay as you enter type, seating 32 passengers. It is equipped with two, 80 h.p. General Electric motors.

NEWS NOTES

FINANCIAL.

NORTH YAKIMA, WASH.—The Washington Public Service Commission recently placed the valuation of the gas plant of the Pacific Power & Light Company here at $201,748, although the cost of production is given at $234,093.

SPOKANE, WASH.—Deeds transferring lands valued at $142,500 to the Spokane Valley Power Company have been filed. J. D. Sherwood is president of the company which is capitalized at $200,000. Announcement is made that a meeting has been called for the purpose of increasing the capital to $2,000,000 to furnish bonds for developing a power site which will furnish 20,000 h.p. A dam is to be built which will give 40 miles of back water on the Spokane River.

INCORPORATIONS.

ALAMAGORDO, N. M.—The Alamogordo Light & Power Company has filed articles of incorporation. The capital stock of the company is $25,000, the incorporators being Col. W. R. Edison, Guy T. Watt and Z. D. Ross. This is a reorganization of the old Alamagordo Water Power Company.

WALLA WALLA, WASH.—Articles of incorporation of the Walla Walla River Power Company have been filed and the promoters of the enterprise, who are Walla Walla and Milton capitalists, are now engaged in securing deeds and easements for rights of way on the river preparatory to starting construction of an electric power plant. The company is capitalized at $120,000, and it is estimated that the plant with a working capacity of 1800 h.p. will not cost to exceed that amount.

ILLUMINATION.

SAN BERNARDINO, CAL.—The city trustees have granted a franchise to the Rialto Light, Power & Water Company.

NEWPORT, CAL.—The board of trustees of this city will receive bids up to April 27th for the construction of a street lighting system.

DRAIN, ORE.—An ordinance has been passed authorizing the council of the city of Drain to construct an electric light plant, and for the issuance of bonds in the sum of $15,000 to pay for the same.

ORANGE, CAL.—The Long Beach Consolidated Gas Company has been granted a franchise to operate a gas distributing system along certain public highways in or near Bay City, in Orange county.

LOS ANGELES, CAL.—The board of supervisors of Los Angeles county will receive bids up to May 11th for installing and maintaining an addition to the street lighting system in the Van Nuys lighting district.

SEATTLE, WASH.—Construction work will be started immediately on the auxiliary steam power plant to be erected on the east shore of Lake Union by the city lighting department. The building will be of concrete construction, and cost $50,000.

JEROME, ARIZ.—An election will be held here May 25th for the purpose of submitting to qualified voters the question as to whether franchises shall be granted to the Upper Verde Public Utilities Company giving right to construct and operate an electric lighting and power system, heating and cold storage system, telephone-telegraph system, gas plant, and gas system, water system and sewer system.

LOS ANGELES, CAL.—The board of supervisors during the past week took up the last extension ordinance for the lighting of Sherman way and the state hightway through the San Fernando Valley. The new extension adds 13 miles of lighted way to the 32 miles now in operation. When fully complete the Sherman way and the state highway will have 178 five-lamp electroliers, 541 three-lamp electroliers, 60 one-lamp electroliers and 60 gooseneck lamps.

HOLLYWOOD, CAL.—An electrical fountain will be one of the features of the arts and crafts festival with which club women of Hollywood expect to raise funds for the erection of their new clubhouse. The festival is to begin April 27 and last one week. It will be held at the Toberman building, Hollywood boulevard and Highland avenue, under the auspices of the Woman's Club of Hollywood. Arrangements were completed for the arts and crafts electrical fountain, which will be an extraordinary innovation. It will decorate the center of the hall.

RIVERSIDE, CAL.—The bid of the City Electric Supply Company, at $3862.61, for the installation of an ornamental lighting system on Tenth street caused surprise as the city's bid was $4200. The accepted bid is 15 per cent under the assessment collected, which amounts to $4568.82. Other bids were submitted as follows: H. P. Bennet, Los Angeles, $4301: Woodill & Hulse Electric Company, Los Angeles, $4327; D. Coldren, Riverside, $4228.75. The type of post used in work of this character is reinforced concrete. Including other classes of lighting, the city now has fifty miles of lighted streets.

TRANSMISSION.

BAKER CITY, ORE.—The South Baker power plant of the Eastern Oregon Light & Power Company was totally destroyed by fire recently. The loss is estimated at $75,000.

SAN BERNARDINO, CAL.—The Southern California Edison Company has applied for a pole line franchise on a number of county roads. The franchise has been ordered advertised for sale May 11th.

SEATTLE, WASH.—A franchise for pole lines, transmitting electricity for light and power over North District county roads, have been granted to the city of Seattle and the Puget Sound Traction, Light & Power Company.

LOMPOC, CAL.—The Midland Counties Gas & Electric Company is contemplating purchasing the Lompoc power plant and extending its high power line here. From here it will probably be extended to Selvang or Santa Ynez to furnish power for irrigation purposes.

OPPORTUNITY, WASH—A power line to furnish additional electric current on the Opportunity-Vera line of the Spokane & Inland Empire Railroad Company is being constructed. The new feeder installation will cost about $4500 and will improve light and power conditions on the line.

GOLDHILL, ORE.—Officials of the Rogue River Public Service Corporation were in Grants Pass recently visiting the company's power site. Geo. E. Sanders, president of the corporation, and Robert E. Gaut, constructing engineer, were in the party. A rumor is afloat that the 5000 h.p. project at Goldhill will be actively under way as soon as the fall of the river permits. Plans call for the expenditure of $500,000. It is probable that the company will interest itself in an irrigation project for the district between this city and Grants Pass, turning the water into the main ditch at this point.

FALL RIVER MILLS, CAL.—The California Power & Manufacturing Company, which obtained a franchise three months ago to operate a power plant and sell electricity in Northeastern Shasta county, has begun operations in earnest. A pole line is being rushed to Glenburn, where much of the power will be consumed for purposes of irrigation. Several representatives of the company have been in Fall River Mills recently, and Leo Haas of San Francisco is sta-

tioned here as general agent and is preparing to open offices here. At present Fall River Mills is the only town in Northeastern Shasta county which has electricity for lighting or other purposes. The present power plant owned by Florin Bros. and upon which the C. P. & M. Company holds an option, is to be enlarged and power derived from the waters of Fall River, as at present. The falls of Hat Creek at Cassel, will also be utilized by the company later for the generation of electricity.

BOISE, IDAHO.—Judge Frank S. Dietrich of the Federal Court has just issued an order permitting the receiver of the Idaho-Oregon Light and Power Company to issue receivers' certificates up to $250,000, to be used in the completion of the Oxbow power plant, located on the Snake River, between Idaho and Oregon. The application of the receiver for his authority was made some time ago, and the stockholders of the company divided on defending and opposing it. The risk to the issuance of the certificates is to be attached to those stockholders who backed up the receiver in his application. They are said to have made arrangements for the disposal of their certificates, thereby raising the money to finish the work on the plant. When the Oxbow tunnel plant was started some years ago by the Idaho-Oregon Company, its backers then had no idea that it would cost the amount of money that it has. The drilling of a tunnel through a mountain of rock and other difficulties that were unforeseen at the time the work was started, took all of the original estimate and additional funds failed to complete the work. The plant is one of the most important to the development of electrical energy in Southern Idaho. It represents a difficult piece of engineering. When the power war broke out among the various big power corporations in the Southern Idaho field, and the stockholders of the various interests began to quarrel, work on the Oxbow plant was abandoned, and since then up to the present time there has been little done. Now the Idaho-Oregon needs the electricity from a large generating plant. A receiver having been appointed for that company to handle its affairs pending the outcome of the litigation that involves it and instituted in the federal court, proposes to supply this energy by going ahead with the completion of the plant and has secured the approval of the court.

TRANSPORTATION.

MIAMI, ARIZ.—The Globe & Miami Traction Company has petitioned the board of supervisors of Gila county, for a right-of-way along the county highway upon the route reserved by the Miami Copper Company for railroad purposes, for construction of an electric railroad in and between the towns of Globe and Miami.

BOISE, IDAHO.—A move is on foot to build an electric road from Twin Falls to the Albee place at Rock Creek, a distance of 17 miles. C. V. Parks or Twin Falls was in the Kimberly district recently soliciting subscriptions and asking the farmers for a right of way. It is hoped to raise $50,000 by subscription, and with this sum the grading of the road can be done.

MODESTO, CAL.—That the Tidewater & Southern Railroad is contemplating the placing of its Modesto depot and other shipping facilities in this city on N street, between Tenth and Eleventh, is indicated by the persistent talk on the streets of negotiations that have been taking place between property owners and railroad representatives recently for the purchase of lots in this vicinity.

SAN JOSE, CAL.—The new owners of the San Jose Terminal Railway, who state that they propose to run an electric line from Almaden, through this city, on to Alviso, there from that town to Port San Jose and out to deep water, there to connect with a line of steamers to San Francisco were granted this week by the mayor and common council the franchises they desired for constructing and operating their proposed line within the municipal limits. The company owns a private right of way from San Jose southerly to Almaden and northerly to deep water in San Francisco Bay, and under the terms of the franchise the portion of the road within this city must be completed by the first of next January. The road has the backing of a syndicate composed of Lee H Landis, president of the Tidewater & Southern Railroad, between Stockton and Fresno; Eric Lindbloom, W. W. Jones, Charles A. Warren and John J. Mahoney, all of San Francisco, and others.

TELEPHONE AND TELEGRAPH.

CLAYTON, N. M.—The trustees of this city have granted a telephone franchise to Frank H. Clark.

WOODLAND, CAL.—The city attorney has been instructed to prepare an ordinance granting a franchise to the Pacific Telephone & Telegraph Company.

SPOKANE, WASH.—To facilitate the settlement of the telephone situation in Spokane, Chas. R. Hopkins, special representative of the Pacific Telephone & Telegraph Company will apply for a franchise.

NAPA, CAL.—R. W. Miner, local manager of the Pacific Telephone & Telegraph Company, has received word from headquarters that the sum of $3100 is to be expended by the company in improvements to its system in this city

TUCSON, ARIZ.—Extensive alterations and improvements representing an expenditure of $25,000 will be made by the Mountain States Telephone Company through North Arizona within the next few months. An entire new plant will be installed at Flagstaff and extensive alterations made at the Williams office. Four miles of new line will be built.

WATERWORKS.

LOS ANGELES, CAL.—The public service commission has favored the proposal to furnish water to the San Fernando valley section this summer, without waiting for the formalities of bringing the district into the city.

TOWNSEND, WASH.—Acting on City Engineer Saddler's report relative to the Snow creek water supply, the council has ordered him to file for the city a water right on a stream about two miles from Snow Creek. The cost of extension was roughly estimated at $7000.

SAN FRANCISCO, CAL.—Private individuals who have complaint against the Spring Valley will not be permitted to associate themselves with the city of San Francisco as joint plaintiffs in the rate suit filed by the city, according to a decision handed down by Judge Van Fleet. A number of these private complainants joined forces recently and employed an attorney with the expectation of appearing as complainants with the city in the last rate suit. Application for the right to do this was filed and the adverse decision was given. Judge Van Fleet said in his decision that the city and county of San Francisco was the only legitimate representative of the consumers and he would not allow any other plaintiffs to join in the suit at this late date.

OAKLAND, CAL.—Frank C. Havens must sign an ironclad option for the selling of the People's Water Company, framed on the terms he offered at the mayor's conference Thursday, according to a statement issued from the mayor's office. It is announced also that Assistant City Attorney C. A. Beardsley will be appointed as Oakland's representative at a conference to be held with the legal staff of the water company, when the option will be prepared. The work of preparing the option is expected to be done in a week. Mayor Mott has sent word to Havens that the communities, in calling the water district election, had lived up to their part of the proposed agreement for keeping the Havens option on the water property and that as an escrew of good faith, at least two-thirds of the capital stock of the water company should be deposited in the Oakland Bank of Savings.

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BY OTTO H. MOHR.

UNDERGROUND ELECTRIC MINE HAULAGE.
BY F. O. BROILI, G. B. BURNHAM, T. R. LANDSBOROUGH AND R. E. MIDDAGH.

POLE TEST CONCLUSIONS.

DISCUSSION ON PUBLIC POLICY PAPER.

PROPOSED NEW TYPE OF RATE FOR ELECTRIC POWER.
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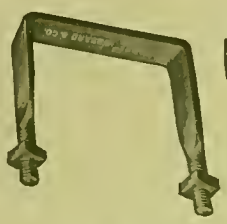
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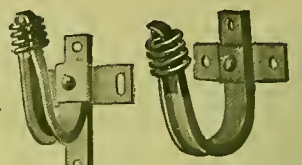
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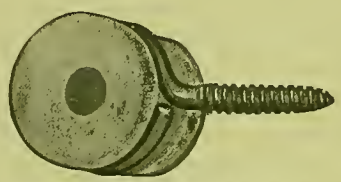
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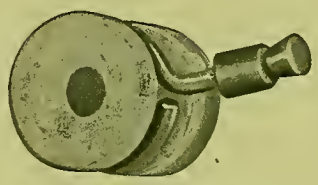
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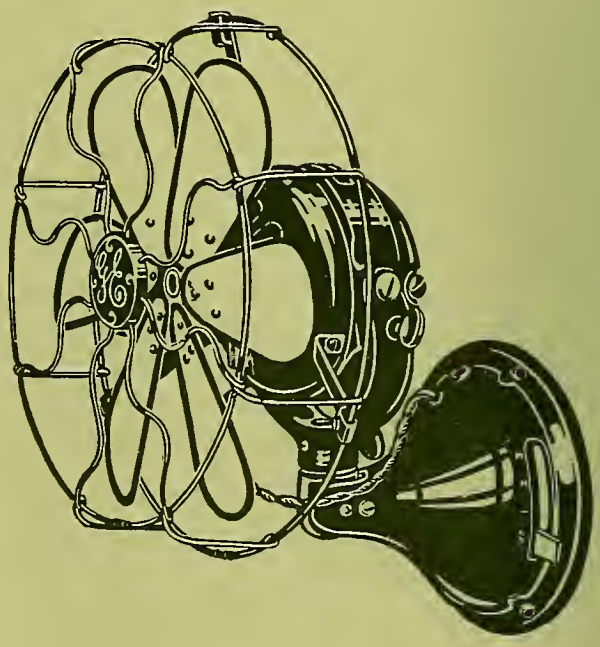


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NEW INDIRECT LIGHTING SYSTEM

BY OTTO H. MOHR.

(This article describes a western product—a self-contained indirect lighting unit. The author discusses the fundamentals of good lighting and describes how these have been secured in the designs and uses of this new system.—The Editors.)

Daylight is a mixture of two kinds of light, and its quality changes continually as the day progresses. It is most satisfactory and pleasing from sunrise until 10 a. m. and from 3 p. m. until sunset, for between these hours the eyes are exposed to the lower intensities and the light is then very diffuse.

At noon, on an unclouded day, daylight is almost entirely sunlight, and at this time an unobstructed surface receives directly from the sun, eighty-five per cent of its incident light, and but fifteen per cent from the sky dome. On such occasions, the intensity is from eight thousand to nine thousand times greater than the eye needs to read ordinary print, and to use the eyes to any extent under this light is inadvisable, especially for close work.

Too strong a glare does not increase lighting effectiveness, but lessens it if too great, for objects cannot then be seen plainly. There is a certain intensity beyond which light not only ceases to be real illumination, but in which it defeats its own purpose by unduly fatiguing the eye. The best lighting is that which produces the utmost clearness without straining the sight, which enables that to be most easily seen for which the system has been planned.

A very large proportion of the "tired feeling" so pronounced in city life, and which differs widely from



Bank Lighting Installation of the New Indirect System.

the weariness resulting from a day in the country, is due to eye-strain. It is a great mistake to suppose that the steady use of the eyes under proper lighting is harmful.

Artificial light requires a much more careful use than sunlight, the latter having been filtered through many miles of air before finding its way to the earth's surface. In this filtering process many of the more harmful rays of light are removed. The extreme rays which lie at either end of the spectrum—the rays outside the red of the rainbow and the rays beyond the



An Architect's Design to Conform to Decorations.

"blue" (known as the infra-red and the ultra-violet)—are very injurious and it is these which hurt our eyes in some systems of artificial lighting.

The problem is, how best to apply the essential natural characteristics and requirements to artificial systems.

The terms direct, indirect or semi-indirect, are merely descriptive in a general way, and really do not give the essential differences in these methods of lighting. The real division is on the basis of the size of the source. The tendency is toward larger sources, whether we obtain them by means of large diffusing and transmitting mediums or by reflection from a secondary light-giving area or diffusely reflecting surface. The important points to consider are the intrinsic brilliancy or surface brightness exposed to the eyes, and the direction of light.

Oculists, engineers and architects have long recognized the advantages of indirect lighting, and even to the average layman its merits have been apparent, but its progress as a universal lighting system has been greatly retarded, due to the fact that in the past, it has been wholly dependent upon the walls and ceiling for its reflecting and diffusing qualities.

The walls and ceiling of any interior require a certain amount of light to show off to the best advantage any architectural or structural design, and where ornamentation occurs, a definite amount and direction is required, but to flood these surfaces with light often results in a very unnatural appearance and also proves to be expensive, due to the high absorption of light from such surfaces. There may also be specular reflection due to the directing of light of high intrinsic brilliancy upon smooth surfaces.

That "decoration is limited to light tints" also constituted one of the strong arguments advanced by the proponents of direct lighting in endeavoring to combat the advance of the new indirect method, while the fear of added decoration costs and the nuisance of constant re-decorating also acted as a deterrent to its general adoption.

To overcome these objections and to duplicate desirable daylight conditions as nearly as possible, a self-contained indirect lighting fixture has been designed and patented by the Mohrlite Company and is illustrated herewith. In this fixture the light flux is projected by a diffuse reflector upon a cone shaped diffusing surface, which forms the upper part of the fixture placed on the ceiling. By properly proportioning the reflector and diffusing surface the light is reflected at the proper angle to the working plane, sufficient light being directed to the ceiling and the side walls without having any visible surface illuminated beyond the allowable range for surface brightness. A wide range of distribution is possible.

The reflecting surface is made of bone and wood ash, and is permanent, easily cleaned, efficient, and above all, gives excellent diffusion.

The diffusion of the light flux by this unit is so good that a less intensity of illumination than usual is required on the working plane. A good diffuse lighting system increases the visual acuity or seeing efficiency, and when this is accomplished a lighting unit is efficient because effective.

There is no limit to the size of the units. For example, in the counsel chambers of the Oakland City Hall, six small domes of 32 sq. ft. each, six rectangular domes of 144 sq. ft. each and three large center domes of 160 sq. ft. each, have been satisfactorily installed.



Commercial Type of Fixture.

The typical photometric curve shows that the "slip light" has received proper attention. Architectural designs, ornamentations or wall hangings, etc., may receive the amount of light required to bring out the true color and design intended.

UNDERGROUND ELECTRIC MINE HAULAGE

(The following papers were presented before the Electrical Section of the Nevada Industrial Safety Conference at Reno, Nevada, on April 20th, 1914. They cover present practice and future possibilities, especially with regard to safety, and several experimental installations are also described.—The Editors.)

SAFETY IN UNDERGROUND ELECTRIC HAULAGE.

BY F. O. BROILI.

(In this article the author reviews the possible danger even of low voltage systems for underground haulage and discusses the requirements of storage battery locomotives for this purpose.—The Editors.)

The use of an electric trolley wire underground presents a source of danger dependent principally on the voltage and whether the underground workings are hot and dry.

Hot underground workings, like those of the Virginia City district cause heavy perspiration, making a favorable condition for severe shock. The writer has in mind a case in which a miner came in contact with a 110 volt, a.c. lighting system in a warm and wet tunnel. The wire, touching him on the shoulder, caused him to get the wire under his arm, rendering him unconscious instantly. His fellow workmen had trouble getting him removed. The shock evidently had some bad effect on his system, as he was put on a hand car and driven to the surface, but he contracted pneumonia and died within forty-eight hours. He did not get over 110 volts, as there were only two wires at 110 volts which were part of a three-wire system, with the neutral grounded. However, if the man had not managed to get the wire wrapped around himself, the shock would have been comparatively slight.

In some of the coal region states, the use of 500 volt trolleys underground is prohibited but 250 volts is allowed. For Nevada conditions, when d.c. is used, this generally requires a motor generator set of some kind as power is obtained mostly from some large power company distributing three-phase. Single-phase mine locomotives have not yet been developed commercially, although some of our progressive mining companies in Nevada some of our progressive mining purpose these have given excellent results. No doubt they will be developed commercially in the near future. The trolley voltage could be about 100, supplied from transformers at short intervals as the high voltage line could be safely insulated. Whether this would prove advisable from a commercial standpoint could be determined only for each individual installation. The object of using the 100 or 125 volt single-phase a.c. would be to reduce the danger, as a 250 volt a.c. trolley in many mines would be very dangerous, decidedly more so than a d.c. system of the same voltage.

A system that will receive more consideration in the future, especially from a standpoint of safety, will be the storage battery locomotive. While fair results can be obtained with lead batteries, the writer is of the opinion that Edison batteries, even at a much higher cost, would be cheaper for any service over two or three years.

Where storage batteries are used, a very important item is the friction of the bearings of the ore car. In some experiments made on two-ton ore cars, hauled by a storage battery locomotive, the writer found that a good type of roller bearing took only one-half the power to operate as that required by a babbitted bearing using 14 in. wheels of the McCaskill type.

This makes a very pronounced difference in the capacity of the batteries required. Experience with the two types of bearings for a year would indicate the average friction of the roller bearings during that time was only 35 to 45 per cent of that of the babbitted, self-oiling bearings. The babbitted bearings under observation were all babbitted with a high grade metal at the beginning of the test. The roller bearings had rolls approximately ¾ in. in diameter, 6 in. long in each wheel and after nearly four years' service, not one single instance of trouble has been reported. They are greased every six months, whereas the self-oiling bearings have to be oiled every week.

The writer believes that storage battery locomotives for the average underground conditions of Nevada offer the most satisfactory solution of mine haulage, at least from the point of view of safety, and, in many cases, from the economic side. The points to consider in making the installation satisfactory are the use of roller bearings and the proper battery for the conditions.

Most locomotives do not have enough battery capacity to do their work efficiently. There should be no hesitancy whatever about adding a trailer to the locomotive to carry sufficient batteries. The batteries on the locomotive should be so arranged that they can be easily removed for repairs to the locomotive, even going to the expense, if necessary, of putting all the batteries on the trailer and having easily removed weights on the locomotive to prevent the wheels slipping on heavy loads, as a mine locomotive has a draw bar pull of only 20 to 25 per cent of its weight. The draw bar pull can be increased by using steel rimmed drivers.

In designing a trailer, elastic spring supports should be provided for the batteries, as these make a great difference in their life.

POSSIBILITIES IN SINGLE-PHASE TRACTION UNDERGROUND.

BY T. R. LANDSBOROUGH.

(The advantages and possibilities of low voltage single phase underground traction are presented in this paper. An experimental installation is described in detail.—The Editors.)

With the development of the single-phase compensated series motor for use in heavy railroading, using current at 25 cycles and lower, the single-phase repulsion motor deserves some mention in connection with mining work for use in small units, especially on 60 cycle circuits. This, I believe, is the standard frequency throughout Nevada.

For underground and surface haulage the single-phase installation will show quite a saving over a d.c. equipment, in that no motor generator set would be required. A motor generator set requires some expert attendance, besides occupying valuable space underground.

Compared to a storage battery locomotive equipment, we have the storage cells and the charging to be taken care of in addition to the motor generator or rectifier set for charging.

Another advantage of the single-phase system is the low voltage that may be used on the trolley wire. I would advocate a trolley voltage of 110 to 125 volts a.c. for underground work as being absolutely safe. This could be accomplished by having a pair of feeders paralleling the track and carrying whatever voltage is brought underground; (440 volts is most common), At intervals depending on the load, transformers may be placed stepping down from 440 to 110 for feeding the trolley.

While 220 volts a.c. has produced some fatalities, 110 volts is deemed unable to do any injury even in very wet places.

Regarding the motor: The control can be made very simple, a reversing switch and two or three steps of resistance being all that is required. With full voltage on the motor terminals, it will develop two and one-half times full load torque at standstill, increasing to about three and one-half times full load torque at about half speed. The motor will therefore accelerate any load that it can start. The motor may be instantaneously reversed without injury, thus making it nearly fool-proof.

Repulsion motors have not been designed in the railway type in small sizes but that will be accomplished as soon as there is a demand. In my estimation, the manufacturing companies have not attempted to develop the possibilities of this type of motor for haulage work for the reason that a single-phase system would deprive them of the sale of motor generator sets and other accessories used in d.c. work.

At this time I might mention a small experimental ore car, designed by the writer, equipped with a 5 h.p. General Electric repulsion motor of the reversible type, having a speed of 1200 r.p.m. This car is of the gable bottom type, side dumping with two doors. The length of haul is approximately 1500 ft. up an average grade of 3 per cent. The car has a capacity of 3 tons and has a full load speed of 8 miles per hour. It makes a round trip in eight minutes or has a capacity of 22½ tons per hour. The car is driven through a back gear reduction and a chain to one axle. This axle also carries a brake drum, an asbestos lined band brake being used. Current at 220 volts is collected from a third rail which consists of an eight pound mine rail bonded and paralleled by a No. 4 copper wire. The track rails are 20 lb. with one rail bonded. Gauge of track is 24 in. This car has been in service for about two months at the Tonopah Extension Mining Company's plant, Tonopah, Nevada, and thus far its operation has been entirely satisfactory, although it is probably a little early to form any definite conclusions. Small cars and locomotives with repulsion motor drive should have quite an extensive field in mining operations both underground and on the surface.

VOLTAGES ON UNDERGROUND TROLLEY SYSTEMS.

BY G. B. BURNHAM.

(The author reviews present practice in the use of electric mine locomotives and in the interests of safety recommends a method of lighting which will aid in eliminating accidents.—The Editors.)

In the use of electric mine locomotives for the hauling of ore in underground tunnel work the question of a suitable voltage for operation has always been important. On the one hand it is desirous to use a high voltage in order to get good operative characteristics, while from the standpoint of safety to the men working in the mine it is even more important to use a low voltage system.

The almost universal practice in mines is to use direct current and about eighty per cent of this is two hundred and fifty volts. Several of the larger mines have used five hundred volts, but there is a growing sentiment against it and the state of Ohio prohibits its use. There is one installation in this country of three-phase alternating current. However, direct current is so satisfactory that the use of alternating current is now limited.

As to the danger encountered in underground trolleys with voltages of two hundred and fifty or over, it has been found that fewer accidents have occurred than might at first be supposed. In some mines the trolley is run in a wooden trough, the sides of which are three or four inches deep, thereby protecting the trolley from accidental contact from the side and also, to some extent, from the bottom. The overhead trolley is not run into the drifts from which the ore is gathered, but the end of an insulated cable on a reel on the locomotive is attached to the trolley, where it stops, and current for operating the locomotive is taken through this cable.

Another common practice toward safety is to locate the trolley at one side of the roadway so that the men will have the middle and the other side of the roadway clear.

Occasionally men and mules get in contact with the wire but fatal accidents seldom happen if the direct current does not exceed two hundred and fifty volts. Alternating current of this voltage would be more serious and also the use of a third rail system instead of a trolley tends to increase the liability to accidents.

In general, where the men are able to see the position of the trolley at all times accidents rarely occur. Many mines have minimized the danger of coming in contact with the wires by the use of diffused light throughout the tunnel. The walls of the passageways at curves, crossovers and junctions and at intervals of five hundred feet on straight track are coated with a band of whitewash fifteen to twenty feet wide and a lamp with proper reflector is used to direct the light against this white strip. The result is that the tunnel is illuminated with a soft diffused light, and, as the lamp is hidden from view, there is no glare. Not only is the position of the trolley easily located but if the mine locomotive or any other object is coming up the track it is silhouetted against the white background making it easily seen.

METHODS AND SAFETY IN UNDERGROUND ELECTRIC MINE HAULAGE.

BY R. E. MIDDAGH.

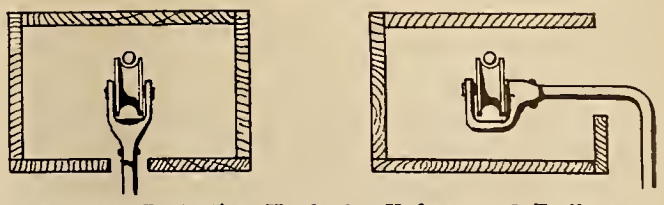
(This paper reviews present electrical methods of mine haulage in their bearing upon safety. The conversion of a trolley locomotive into one using storage batteries is also described.—The Editors.)

The present day methods of mine haulage can, roughly speaking, be divided into two general classes i.e. animal and mechanical, and these two main divisions can again be segregated into sub-headings without number. Considering the scope of this paper, however, we will discuss only the motor driven electric type.

In treating the above subject for convenience sake we will divide it into two parts, each to be gone over separately, followed by a discussion of the recent work done at the Steptoe Valley Smelting & Mining Company's plant at McGill, Nevada.

We will first take up the underground mine haulage by what is commonly called the main line trolley system, showing both its advantages and drawbacks but keeping always in mind the object of this paper, namely Safety First.

The underground trolley systems of today are with few exceptions of the direct current type and most generally carry 250 volts on the trolley, although there are places where a.c. is used, notably the Wellington Mines Company, Breckenridge, Colo., where a two trolley and ground three-phase a.c. system is in practical operation. This latter installation goes to prove the practicability of the a.c. current for underground work but the author can see no advantages gained thereby which could be applied with safety to mines. The main advantage of either poly- or single-phase a.c. current would be to use a rather higher voltage on trolley and feeder, thus eliminating to a great extent the line loss and consequent drop in voltage which in some mines amounts to considerable. But when considering this advantage from the point of view of the safety engineer it is totally eclipsed by the increased danger to those who have to work where it is used. The standard 250 volts for trolley, whether of a.c. or d.c., seems to be the ultimate for underground service if safety and economy are both to be considered. A higher voltage puts undue risk on those working nearby and a lower voltage entails too great an increase in first cost of the trolley and subsequent line losses to be practical. The author does not want to make the statement that 250 and no other voltage can be used, for under certain conditions a higher voltage could be used to advantage and with the same degree of safety but as a general rule in mines the 250 volt trolley should seldom be exceeded and then only after a most careful study of all working conditions. There has been much discussion as to a protecting hood for trolleys whereby accidental contact would be made impossible and so permit of a rather higher trolley voltage, but though the writer has seen many such schemes on paper such as those here illustrated, he has yet to know of one which has been in successful operation or to hear of one the first cost of which would not be prohibitive. As to the relative advantages of a.c. or d.c. current underground other things being equal, I would like to make the following points; from the commercial end d.c. seems to have at least a shade the best of it at present, due mainly to the design of motors and control apparatus. A d.c. motor shows as a rule a better all round efficiency, as for example at a given torque on starting it does not require the excessive current necessary to the a.c. motor of either poly- or single-phase. Again we have in the control apparatus of d.c. motors a point in favor of this system, it being as it is much more flexible than anything as yet produced in the a.c. line. And again coming back to Safety First we find the danger in case of contact, less with d.c. It is a commonly known fact among electricians that while a man has comparatively little trouble in getting away from a d.c. wire, the a.c. has a tendency to hold him in contact. So in summing up the two methods it seems to the author that the logical system from an engineering as well as a safety standpoint is the d.c., using as low a trolley voltage as is permissible without undue loss.



Proposed Protecting Hoods for Underground Trolleys.

Secondly we will consider the storage battery loco system which at the present time bids fair to supplant the main line trolley in many, if not all installations and also admits of application in many cases where the comparative high first cost of the main line trolley is prohibitive. There are several prominent installations of this system throughout the country, the Alaska Gastineau Mining Company and the Ore Reduction & Transportation Company of Idaho Springs, Colo., being two that come to mind as most typical. Of these two we will only consider one, the Big Five Tunnel installation of the Ore Reduction & Transportation Company, as from information obtainable this seems to have been the pioneer installation to be equipped with the new Edison iron-nickel cell, which cell it is claimed has done more than any other one item to make the undertaking a success. The loco is of the Westinghouse-Baldwin Scotch yoke type, carrying its battery of 208 type A-6 latest improved Edison iron-nickel cells on a trailer or battery car and being equipped with a trolley pole for use outside of the mines when engaged in switching or other yard service. This installation was put in to replace mule haulage and has not only proved entirely satisfactory but has shown a material decrease in the transportation charges per ton-mile, as shown in the accompanying table. The equipment here is rather unique, combining as it does the advantages of the storage battery underground and the low cost of operation of the main line trolley on the surface, a combination which in this case at least leaves little to be desired from either an engineering or a safety point of view. The battery loco immediately presents advantages to the trained engineer that no other system can equal. The first cost is small, small in comparison to the main line trolley, as trolley wires and other auxiliary equipment underground becomes unnecessary and right here it might be well to mention that this fact also removes the danger to the underground men and safety arises as a head liner under the advantages of this system. Safety from accidental

TABLE.

Comparative Statement Mule and Electric Mine Haulage.

Mule Haulage.

Month.	Labor.	Teams.	Cost.	Ton-Miles.	Cost per Ton-Miles.
July	291.20	199.60	490.80	4290.2	.114
September	299.10	181.45	480.55	4620.6	.104
October	326.95	143.80	470.75	4921.1	.096
Average				4610	$0.1043

Storage Battery Haulage.

Month.	Labor.	Repairs.	Power.	Ton-Miles.	Cost per Ton-Miles.
December	200.50	34.18	56.21	4451.5	.065
January	192.25	54.14	55.60	4490.6	.067
February	259.75	32.36	58.30	4832.0	.073
Average				4590	$0.0683

Saving effected $0.036 per ton-mile, or nearly one-third. Months were taken that correspond nearly in ton-miles hauled.

contact with live wires and also safety from trolley sparking which in many mines, where explosive gases are present, is a menace not to be overlooked. Again, we have a flexibility heretofore unknown to the electric motor, no stopping a hundred feet or so from the headings on account of uncompleted trolley, no waiting for repairs to an accidentally damaged line and consequent to that no working on a hot trolley under the most unfavorable of conditions when even the most experienced and careful of electricians are so apt to make a false move with the inevitable result of an accident of a more or less severe nature. Of course there are drawbacks as well as advantages to this system, the rather higher operating cost than for main line trolley and the liability to "run short" being two of the most important but after a closer study of these drawbacks the writer is of the opinion that they can be classed with the mole hill rather than with the mountain. The danger of "running short" while underground is slight if proper precaution is taken as to charging and the motor man well instructed as to determining the condition of his battery. While there is no gainsaying the rather higher operating cost of this system over the main line trolley, it is a matter of much speculation as to whether or not these costs can not be materially lowered in future installations and even though they are not materially decreased, whether or no the extra cost is not money well expended in the cause of Safety First. The author is of the opinion that it is.

As a conclusion to the foregoing paper I wish to add an account (as far as we have gone) of how the author is working out the conversion of electric locos built for trolley service, to the storage battery system. I wish to bring out two points—the practicability of and the advantages gained by this change.

The apparatus in question consists of two Westinghouse-Baldwin 10 ton locos built for trolley service at 220 volts, which were bought for our mines but never used. The conditions are the replacement of steam engines for concentrate haulage from our mill to the scale house half mile distant pulling a dead load when loaded of 278,000 lb. and 75,000 lb. empty. This will be 176½ ton-miles per round trip, eith of which are on an average made per shift of eight hours. In the mill building there is a run of approximately 200 yd. under the concentrates tanks where very little head room is available and then only to have structural steel near you. It is this indoor run that has necessitated the replacement of the steam engine with its consequent smoke and it is also this run that has made a trolley installation both expensive and dangerous, although low trolley wires even on the outside were not considered as best, due to road crossings and the combined use of the rails or both steam and electric service. After it was decided to use storage battery locos, the reconstruction of the old ones started. First they were changed from a thirty to a standard gauge, a job which proved quite simple and then calculations for battery equipment were put under way. While we have not as yet definitely decided on the battery to be used, the preliminary figures seem to point to the use of a trailer equipped with either 190 cells of type A-8H or 210 cells of type A-6H Edison iron-nickel storage battery and using the same motors and control apparatus, without change in any way, as were already on our locos when equipped for trolley service. While I am not in a position at the present time to give figures on this installation, I would say that the first cost with batteries is considerably less than the trolley would have been and all things considered I do not expect the operating costs to run much, if any, above that of the trolley. We also have the advantage of being able to run our locos wherever standard track is available whereas should we have decided on the main line trolley our operations would have been limited to the half mile run of electrified road.

POLE TEST CONCLUSIONS.

Tests by the Forest Service of the department of agriculture on poles and on specimens cut from them, show that—

1. Air-seasoned lodgepole pine poles cut from live timber in Montana were fully equal in strength to the cedar poles tested. In actual stress developed they were superior, but on account of the greater taper of the cedar poles this advantage was lost in a comparison based on equal top diameters, the dimension usually specified.

2. Cedar poles were superior to the pine and spruce poles cut from a fire-killed area in Colorado, in maximum load developed. The three shipments were, however, practically equal at the elastic limit. Were the native poles to be used in place of cedar without change of specifications, it would follow that the factor of safety would be reduced one-fifth for conditions at failure, but would remain the same for stresses at the elastic limit.

3. The fire-killed pine, after standing 10 years, did not show deterioration to any appreciable extent when compared to seasoned lodgepole pine cut from representative live trees in Wyoming and Colorado. The advantage in strength of the material from the lodgepole pine poles from Montana can be accounted for by the fact that it was above normal in weight—at least for lodgepole pine from the southern part of its range.

4. The ratio between the strength of the poles and the strength of the clear material cut from them is not constant for the different kinds of wood. This "efficiency" factor varied from 0.74 to 0.48 of the strength of the clear wood when the comparison is made as tested, and from 0.98 to 0.65 when compared on the basis of values estimated to represent the same moisture condition in the small pieces as existed in the poles when tested. The values were highest for the cedar and lowest for the spruce, the pine representing an average for the three species.

PUBLIC POLICY OF PUBLIC UTILITY CORPORATIONS

DISCUSSION ON PUBLIC POLICY PAPER.

(This discussion followed the presentation of Mr. John A. Britton's paper at the San Francisco Section meeting A. I. E. E. The paper was given in full in our last issue. A. H. Griswold was chairman of the meeting.—The Editors.)

The Chairman: Illustrative of the point which Mr. Britton has made, that the success or failure of a public service corporation does not rest with its officials, but rather, to a very great extent, with the rank and file, I am reminded of what the general manager, or, as Mr. Britton has said, the paymaster of a large corporation, once said when granting some increases of salary, "I am not granting these increases because the company has lots of money, because it has not; but I am granting them because I want you to help me."

C. L. Cory: Mr. Chairman and Gentlemen—As I was listening to the presentation of this very important subject by Mr. Britton, one word came into my mind as perhaps most thought of by the speaker, the word "mutuality." Certainly the great corporations today entering upon the work that is to be done and can only be done by corporations, first of all, accept a great responsibility.

I cannot help but liken the corporation of today to the central pier of a bridge over a torrential turbulent stream, that however is for long periods of time quiescent. First, the corporation has its responsibility to its own individual stockholders, whose interests unquestionably should be protected, not only by the corporation itself but by any relationship that this corporation may have to the commonwealth, the state or city in which such corporation may carry on its business. Second, unquestionably the corporation accepts an obligation, and a very great obligation, to its own employes. Finally, of course, its principal and most direct obligation is to its customers.

On the far end of this bridge one finds the people who receive the service; on the other end are the employes of the company; the corporation is solely responsible for the stability and reliability of the structure in storm as well as in fair weather.

As engineers, and those interested in the profession of engineering, I think we cannot too carefully give heed to one point very strongly brought out in the paper, the obligation of the employe of the corporation to the organization he represents. It is a serious thing for a man at any time of life to find that the road that he has traveled, in some way entirely beyond his control, is blocked, that he cannot journey along that particular highway any further. A great number of employes of corporations, I think, appreciate today more than ever before that the real and ultimate success of the corporations is very closely interwoven with the individual success of its employes and the practice of the profession of engineering depends primarily upon loyal service.

To speak frankly I think all of us here are perhaps well aware that today there are many men, able men, near middle life, who have given the best years of their service to corporations, and now, through no fault of either their employes or themselves find themselves dependent upon absolutely new fields of endeavor. It therefore behooves us as engineers to give thoughtful consideration to the point that has been brought out this evening by Mr. Britton on the Public Policy of Corporations. We all know that human nature is much the same in all of us. It is difficult for us to see the other fellow's side.

I am reminded of a little story that I read the other day, about a young lady school teacher, who sent a little girl named Elsie, one of her pupils, out to buy some plums, telling her that she should pinch one or two of the plums before buying them to make sure they were ripe. In a little while Elsie returned smiling radiantly and very happy. She said, "I pinched one or two of the plums as you told me to do, and then when the man wasn't looking I pinched a whole bag full. Here are the plums and I brought the money back too."

The attitude of that little girl illustrates human nature, and without saying unkind things about the attitude of the people toward corporations, I think that perhaps some of us at times, particularly when the telephone service is not at its best, or during a very cold season when the gas company may have had great difficulty in distributing gas in a practically new territory, which had been comparatively little inhabited prior to the great catastrophe, I think we generally are very much inclined to take the point of view of little Elsie whose idea of mutual obligation is absolutely the opposite of the Public Policy that has been outlined by Mr. Britton.

We are hearing today about the difficulties that some investors have had in various corporations, one in particular, an Eastern railway system in old New England. Such financial wrecks are to be greatly regretted. There is no question about that. What the ideal is and the mutual obligation, of course, as outlined this evening, is that those people who are willing and find it to their interest to place their funds, such as they may be, in the hands of a great corporation can rest assured that those funds will be handled with just as much care, just as great security as might be possible if the funds were placed in one of our Federal banking institutions.

Again, I was reminded while Mr. Britton was readng his paper of the mutual necessity of any relationship being an advantage to both people. I recall a very large electric power contract that was under consideration a few years ago on this side of the Rocky Mountains. The situation was something like this: A large mining company, low grade copper company in fact, had been using steam as the source of power. The amount of ore crushed and treated had increased from 1907 to 1912 from 7000 tons each day to 20,000 tons per day. The cost of power, even using fuel, had been reduced from 13 cents a ton to about 6 cents a ton. The time had come when the burning of fuel, coal in this case, did not seem desirable. An arrangement was then being considered for the purchase of a large amount of electric power, anywhere from 12,000 to 30,000 h.p., this contract to be in existence not less than 25 years. It was assumed that this particular mining company would be busy at the rate of 20,000 tons for about 150 years in recovering that very useful metal, to all electrical men—copper—from that mountain into the copper that might be of service. The head of the mining company, in giving advice to those who were to represent that company in these negotiations, gave these very striking instructions:

"Now, in discussing this contract, please understand that the line of mutual interest between the hydroelectric power company and our mining company is just as artificial as the dividing line between the northern boundary of Utah and the southern boundary of Idaho." "No obligation"—to use his own words—"is worth while, unless it is mutually satisfactory, not for a time, but for as long as the obligation can be maintained; and what we want here is to stop burning coal, the natural resources of this community and use this water in the mountains to produce power with which to reduce the ore and thereby take advantage of one of our natural resources, water, and conserve the other for a different use. In discussing this contract then, bear in mind we want noth-

ing we should not have, nor do we want anything that, if the interests were reversed would not be the principles you would stand for."

That, gentlemen, is the crux of the entire situation. In this matter of the public policy of corporations, as far as employes are concerned, or as far as the service to us as consumers is concerned, it is not the thing that is of advantage to you or to me today; the thing that is worth while will be the thing that is of advantage to both of us if we are mutually related, to both of us in all endeavors, not for a short time, but for all time.

Finally it seems to me that perhaps one little expression might cover the sentiment that Mr. Britton has given us. It does not make any difference to those concerned, whether we may be placed in the very important position of responsibility of directing the policy and operations of the great corporations and the service they are now giving could never be accomplished in any other way, or whether perchance we may be in any relation an employe of these corporations, or whether the success of our endeavors may be dependent upon the opportunities that may come to us from such corporations, what Mr. Britton has said to us this evening, is merely this: "To thine own self be true."

A. H. Halloran: Mr. Chairman and members of the Institute, while listening to Mr. Britton's ideas as to what should be the public policy of a public service corporation, I have been impressed with the thought that Mr. Britton has presented what may well be called a declaration of principles. His declaration is on such a high ethical plane that it may be difficult perhaps for every corporation to live up to all that it implies, but regarding it as an ideal toward which every employe of every corporation should work, it can do much in gaining the friendship and confidence of the people.

"Success is the science of being believed in."

If the public firmly believe that the corporation is trying to live up to these ideals, the corporation's success would be assured, and the prevalent feeling of hostility toward the public service corporation would be eliminated.

This feeling of hostility is largely the fault of the corporation in not telling its side of the story. Politicians and newspapers frequently make misstatements of facts, which the corporation allows to go unchallenged, and so the politician wins merely by the default of the corporation in putting the real facts before the people.

Professor Cory's "mutuality of interests" suggests that the relation between the public and the public service corporation is one of partnership, and that whatever hampers the corporation retards the development of the community served. If this fact could be impressed upon all the people it would do a great deal to counteract any hostile feeling.

Another viewpoint of the relation between the public and the corporation is that taken by Mr. Max Thelen, commissioner and attorney for the California Railroad Commission, who regards the corporation as the "agent" for the public, as "principal."

While these two viewpoints differ in many respects and lead to different conclusions, they have one point in common—the necessity for frank and open dealing with the public. In order to improve the relationship, the managing partner should keep the silent partner fully informed of the conditions of the business, the agent should keep his principal posted on the status of his affairs. In other words, the salvation of the corporation depends on free and open publicity. Consequently every means should be used—lectures, the courts, the press—in converting the people to the idea that the corporation really has their interest at heart.

In what may be termed the private policy of the corporation, Mr. Britton has outlined the first step of this campaign of education. Once these principles of loyalty and of enthusiasm have been instilled into the mind of the employe, who by the way, is an integral part of the public, he can make it known that his is a "corporation with a soul."

This idea of the corporation with a soul, is the keynote of the new policy of winning friends. Nor is the soul the indefinite hypothetical thing that we were perhaps taught in the Sunday school.

In his book on "Crowds," Gerald Stanley Lee defines a man's soul as "the faculty in him for seeing the whole in relation to the part—his vision for others in relation to his vision for himself." But is not this the very object of true public service, and should not this spirit, or this faculty, be the actuating impulse in every public service corporation?

Regard the corporation soul as the sense of proportion concerning the rights of others, let it combine the ideal of the service of all men by all other men with the conception of the value of the individual; express this spirit as an active working principle in all business dealings, and the corporation will be believed in, if proper publicity be given to this change of attitude.

The problem of teaching these facts to the Pacific Coast public is different from that of educating the people in Eastern communities, and requires local action. While National associations have given much thought to the subject, they have not had the necessary machinery to get action. Conditions differ greatly in each section of the country, and a specialized campaign suitable for the New England states would not meet the needs of the Pacific Coast. All kinds of public service corporations here have a common cause in creating a more favorable public opinion. While other interests of electric light, electric railway, steam railway, telephone and gas companies may be divergent, their problem is identical in educating public opinion.

This in turn means reaching the individual, for the public is only an aggregate of individuals. A single drop of water in itself is weak, yet combined with millions of other drops, and given the advantage of a difference in elevation, it can sweep aside everything in its path. Thus it is with public opinion—given motion and number it is irresistible. The machinations of lawyers and politicians can no more stem the flood than can the utmost contrivance of the engineer stop the force from a broken dam.

Without proper guidance power vents itself destructively. If led through proper channels, it can be utilized beneficially. So public opinion can be educated, literally led out, by a properly planned and executed campaign of publicity.

The most logical solution of the problem would be the formation of an association of all utility companies. They should first get together and discuss the conditions, then come out with a frank and open avowal of their purpose, realizing that "Honesty is the best policy" of a corporation as well as an individual.

The Chairman: I am going to ask Mr. Babcock to continue the discussion.

A. H. Babcock: Mr. Chairman and Mr. Britton—One point I was a little surprised Mr. Britton did not bring out, the value of having the employe, in his daily contact with the public, do his part toward the education of that public, toward the stopping of senseless complaints. I think probably we railroad men come in contact with the public in a more intimate way than the servants of some of the other public service corporations. The senseless and endless complaints of the traveling public over the ordinary delays of traffic, over the ordinary discomforts of the dining car or of the sleeping car, become so burdensome to a railroad man that he is prone to lock himself up and shut himself away from the public. I know I have done it and done it repeatedly. On the other hand, I have seen opportunities for helping direct public opinion.

I think it is within the power of every one of us to check the little annoyances of the public with whom we come in

contact. Let them see the other side, the things that we have to contend with, so that when there is complaint about the light going out or the regulation being poor or the trains off of their schedule, there can be a better understanding by the public.

Another point Mr. Britton brought up, the loyalty of the individual to the company. He said, if I remember correctly, that he had no use for a man who was not absolutely loyal to the company. The corollary to that is this, the obligation on the part of the upper officers of the company to see that there is ground for our being loyal and to see that there is an example in the top ranks that forces the follower to follow whether he wants to or not. It is not possible for all of us to be entirely free and independent; it is not given to every one of us to be able to say "If I cannot subscribe to the ideas of this concern, I will go elsewhere." Sometimes we are obliged by bread and butter necessities to live our official lives under men who have not been the corporate leaders that they ought to have been. Very happily in the majority of cases on this Coast the reverse has been the case, and there is no excuse for not being loyal, loyal in every sense of the word. My particular summing up of the situation, and my belief is that every one of us coming in contact with the public should do his part to train and to educate the public so that our point of view will be seen quite as prominently as theirs.

The Chairman: Is there any one else that would like to contribute to the discussion? Mr. Britton, would you care to say anything in closing?

John A. Britton: Just a thought, Mr. Chairman, brought out by what Mr. Babcock has said; that is, with respect to this attitude of the general public towards the corporations.

I mentioned in my preliminary statement that I had a talk with a body of men at Sacramento today, the subject of the attitnde of the public was my theme and my only theme, and I was gratified at the close of the address which I gave there at the enthusiasm with which the suggestions that I made in that line were received, and it gave me a new line of thought. They were business men that I was talking to, men of affairs, all of them, men who had made a success in their own particular line of life, and they were all thinkers, the idea came to my mind then and subsequently as I journeyed from Sacramento to here, that there has been a lack on the part of the corporation man in presenting his view point to the public and impressing the public with the sincerity of the corporation's side of the question. Most men engaged in their own business affairs have little time or consideration for others unless their interests lie along parallel lines, and it is astonishing to me as a corporation man to note the indifference that exists even on the part of stockholders of the corporations as to its welfare. And I attribute that largely to the fact that they are not as thoroughly advised as they should be any more than the business men are advised nor the general public; and I believe with Mr. Halloran that there should be and is going to be on the part of corporations from now on more of that publicity, more of that taking the public into the confidence of the corporation. Of course, it is being forced upon them by this public regulation. And I want to say in emphasis of that fact that I believe the best thing that ever happened in the state of California was the renewed activities, the reformation, I might say the re-formation as well, of the railroad commission. Every public service corporation man who is honest in his own intent cannot help but welcome a regulation that takes the question of his operations out of the hands of the general public, because the general public is a most uncertain thing. It has thoughts and fancies today that do not comport with its thoughts and fancies of yesterday, or of tomorrow. And the employes of corporatons, being hut human beings and pursuing always the path of least resistance, have allowed themselves, in order to be friends with everybody, to get into a condition that needed reformation, and that can only be brought about by such a body as the railroad commission is now, in the state of California, in Wisconsin, New York, New Jersey and in a great many of other progressive states, and we welcome that. But what I want to convey to you is that, that my thought today after my address in Sacramento, was that we corporation men had made a great mistake all of our lives in not talking plainly and frankly with the people with whom we came into contact, that we were hiding our light under a bushel and that by reason of our silence everything that we did was taken under suspicion; and this plan of publicity is going to be worked stronger and stronger in this state; and when the public realizes that a corporation, as I have said before, is a mere aggregation of individuals, each with the same aims and impulses and morals as affect other individuals, and that it is their duty to give service, and that people should be lenient of faults and failures the same as the faults and failures of individuals in their daily lives, we would come to a better understanding; and again quoting Mr. Halloran, the question of rates would be the last thing. It is not the question with most people as to whether their bills are more or less than they were. The general feeling of the person purchasing the commodity from a corporation is that he is not getting service. That is the first thing that creates complaint. If he understands the trials and tribulations in that service, he will be very easily satisfied. For the corporation man is no more than a mere merchant, the only difference being that while the corporations are manufacturers they cannot distribute in tin pails or in express packages. If they could do that they would be most popular; but they must, by reason of their character of service, deliver it in a certain way to a consumer, and he knows nothing of the question of the measurement of that supply as he does of the pound of sugar or sack of potatoes, and when it reaches that point where the public understands it, I feel confident that we will have reached that point where there will be satisfied consumers, satisfied employes and satisfied corporation stockholders.

Harnessing of power of the river Nile has been brought to the attention of the British government. The town of Dametta is to be lighted by electricity and power is to be used for silk weaving. Government ownership is being advanced. There is said to be available at Assouan a minimum of 50,000 h.p. One horsepower will manufacture two tons of calcium cyanide in one year, and it is estimated that the Assouan energy could thus turn out 100,000 tons per annum—that is to say, $4,500,000 worth of the fertilizing agent most extensively required in Egypt. Another use the power could be put to is summer irrigation, street lighting and railway operation.

A Canadian hydroelectric fertilizer plant is to be erected by American capitalists on the Saguenay River, water power privileges having been secured from Lake St. John to tidewater in the Province of Quebec. It is said that some 300,000 horsepower is to be developed at an estimated cost, for development of hydroelectric power and construction of plant, amounting to $60 or $70 per horsepower, to be used for the production of phosphoric-acid fertilizer in electric furnaces by heating phosphate rock (Florida pebble) with silica or sand. It is claimed that approximately 3 tons of 45 per cent double superphosphate can be produced per horsepower per annum in the proposed plant.

SELLING ELECTRIC SERVICE

PROPOSED NEW TYPE OF RATE FOR ELECTRIC POWER.

BY FRED O. DOLSON.

The many different types of rates for electric power (and light) now in use by the various power and light companies and the fact that most of the rate schedules are difficult for the consumer to compute or even understand, are reasons why we should all strive to arrive at some simple type of rate which shall be fair to both consumer and the company.

The primary requirement of any fair rate is that the consumer shall pay a rate exactly proportional to the cost of serving him.

As practically all consumers want electricity delivered to their premises at all times, whether they actually use it one hour or twenty-four hours per day, it is here conceded that the service charge of so much per month per horsepower or kilowatt of maximum demand is a fair charge. Whether or not this service charge (sometimes called "Readiness to Serve" charge or "Maintenance and Installation" charge, etc., etc.) should be additional to the kilowatt hour charge or merely absorbed as a consumption charge thus regulating the minimum monthly bill, is beyond the scope of this article and can be handled either way in the proposed type of rate.

Assuming that a fair service charge has been arrived at, the charge per kilowatt hour should be exactly inversely proportional to the load factor. The consumer who ordinarily uses power (or light) only one hour per month is surely not as desirable a customer and is not entitled to as low a rate (even though he pays a service charge) as the customer who uses it eight hours or 24 hours per day and it is here contended that a fair rate to both consumer and company must be lower for each succeeding hour it is used throughout the month.

A rate that meets this requirement is here submitted. (Dolson Rate). "A service charge of $1 per horsepower per month (based on maximum demand) plus a meter rate of two cents per kilowatt hour, with a discount, e.g. (50 per cent times the monthly load factor).

Note: The service charge, two cent rate and 50 per cent base discount in the above were chosen for the purpose of comparison with some existing irrigation rates and may be changed to suit local conditions and different classes of business without affecting the type of rate.

The first advantage claimed for the above rate is that it can be easily explained to the consumer. For example: Say to the consumer, "Your maximum demand is one horsepower and your bill will be one dollar per month service charge, and in addition to this two cents per kilowatt hour as shown by your meter reading. From this amount you will be allowed a discount of fifty per cent if you operate continually; if you operate half the time, your discount will be one-half of fifty or twenty-five per cent while if you only operate one-tenth of the time, your discount will only be one-tenth of the basic discount or five per cent and so forth."

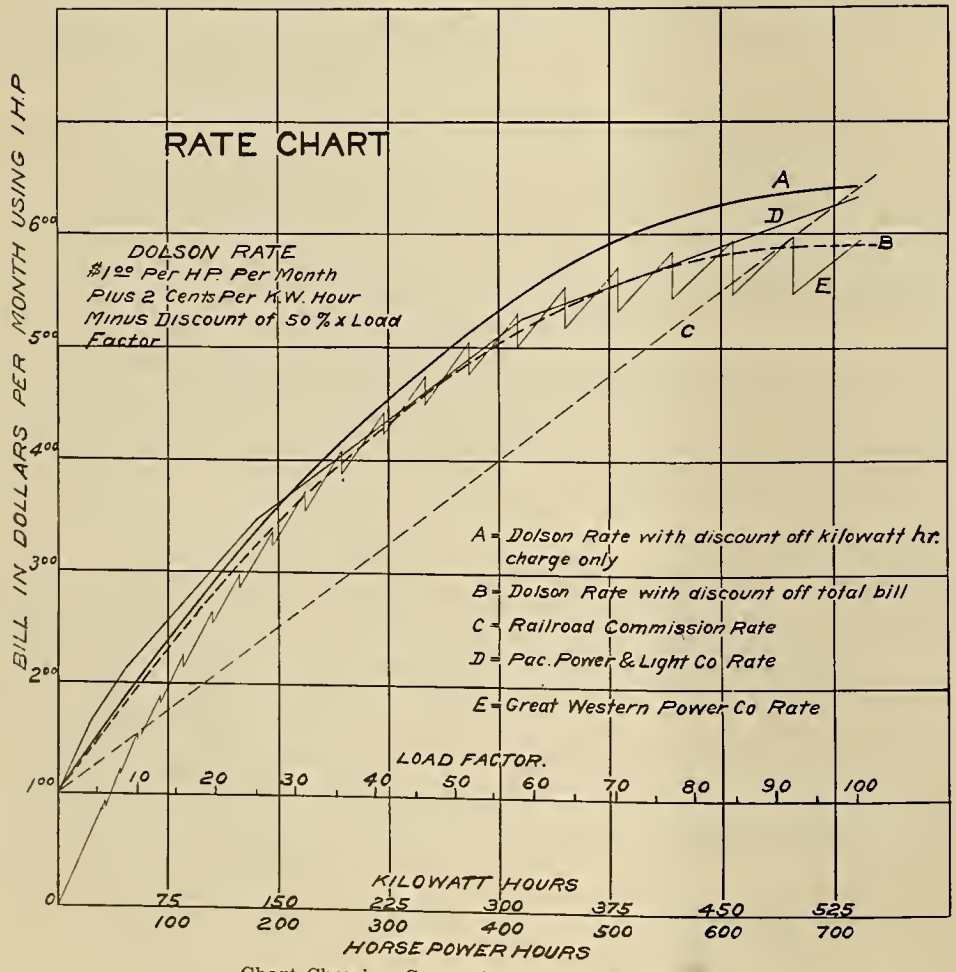


Chart Chowing Comparison of Irrigation Rates.

A comparison of this rate with the rate for irrigation established by the California railroad commission for the Northern California Power Company is interesting, because both rates are the same at zero load factor and the same at 100 per cent load factor; while at 50 per cent load factor the proposed rate is more than $1 higher than the railroad commission rate.

The railroad commission rate reads: "One dollar per horsepower per month service charge, plus one cent per kilowatt hour"; thus making the consumer pay just as much for each succeeding kilowatt hour as for the first. A graphical comparison of these two rates is shown on chart (see curves A and C).

For a second comparison, the agricultural rate of the

Great Western Power Company (as published on page 135 of Journal o Electricity, Power and Gas, issue of Feb. 8, 1913) is used. The Great Western Power Company's rate is a block rate, reducing as the load factor increases and while it results (in the writer's opinion) in a type of rate curve fair to both consumer and company, the changing of rates at certain load factors, instead of a continued gradual reduction, results in a saw tooth rate curve (as shown on chart, see curve E) and makes not only a complicated rate to understand, but one which can be juggled either by the consumer or company. For example: On a one horsepower installation, the consumer looks at his meter and finds he has used 345 kw.-hr. and his bill will be about $5.53. Looking farther down the rate, he finds he can use two kilowatt hours more and actually reduce his bill to $5.20; or he can even use 195 kw.-hr. more (making his total 540 kw.-hr.) and his bill will be only $5.40.

A graphical comparison of the proposed "Dolson" rate and the Great Western Power Company rate is also shown on chart (see curves B and E).

Note: A great many companies use the above described type of block rate apparently for lack of a more suitable rate.

The type of rate now in use which most nearly approaches the ideal, is the Irrigation Power meter rate of the Pacific Power & Light Company of Portland, Ore. This rate is $12 per year service charge, plus a monthly meter rate of

3c per kw.-hr. for first 30 kw.-hr. per rated kw. demand.
2c per kw.-hr. for next 30 kw.-hr. per rated kw. demand.
1½c per kw.-hr. for next 120 kw.-hr. per rated kw. demand.
1c per kw.-hr. for next 240 kw.-hr. per rated kw. demand.
½c per kw.-hr. for balance kw.-hr. per rated kw. demand.

This rate is shown graphically on chart with Dolson rate (see curves B and D) and it will be noted that although the rate reduces at certain points (instead of continually) there can be no sudden reductions or variations in the monthly bill, as in the block rate. The principal objection to this rate is the consumer's difficulty in computing his bill.

The purpose of this article is to call attention to this new type of rate, and the amounts used in examples for service charge, kilowatt hour rate and base discount are not held to be correct for any class of service. A study of the rate proposed will demonstrate that by changing the different factors, the rate curve can be made to conform with almost any equitable rate now in existence. For example: The rate given with 50 per cent base discount applying on both meter rate and service charge, results in rather a sharp curve at load factors above 50 per cent and becomes almost tangent to the horizontal line of the chart at 100 per cent load factor (see curve B).

By reducing the kilowatt hour rate and the base discount, the radius of the rate curve can be made anything between the curve shown and the straight line rise of the railroad commission rate.

Pacific Ocean wireless messages between San Francisco and Honolulu, a distance of 2350 miles are now an every day occurrence, and wireless messages also travel 2100 miles between Lima, Peru, and Para, Brazil.

THE ELECTRIC COOKING OPPORTUNITY.

BY S. J. HALLS.

(The author of this article has had wide experience in developing the electric cooking opportunity and his remarks, conclusions and revenue data herewith are all of value to central station and appliance salesman.—The Editors.)

The careful housewife is ever on the lookout for something new for the home, provided, of course, that the initial cost is within reason and the operating expense likewise.

The rapidly increasing popularity of electrical appliances is making vast changes not only with the manufacturers, who are ever ready to pioneer in developing something more efficient, but with many thousands of housewives who have been able, owing to the many labor saving appliances, to rearrange their duties to great advantage.

The electric range is perhaps the one article which attracts the attention of most ladies, although, for that matter, everyone is more or less interested in the preparation of foods for the family, and with the dependable makes of electric ranges on the market to-day, and the (in most places) reasonable rates charged for energy, it is no wonder that a tremendous increase in electric cooking is taking place. It is a very great mistake to think that electricity for the household, for cooking, washing machine, vacuum cleaner and the many other little appliances, is only for the well-to-do. These, at any rate in this country (British Columbia) usually employ Chinese servants, and a Chinaman, rather than adjust himself to new conditions, would as lief sweat over an old coal stove. It is to the middle classes, and particularly to the housewife who does her own work, that central stations must look, at any rate for the present, for an increase in cooking business. There is no doubt but that many people are these days studying economy, and in this connection electricity stands ready to do its part. To the average housewife the use of electrical appliances means much, being always ready and clean. Cooking with electricity becomes a pleasure rather than a duty, and with careful consideration of the various articles to be cooked is extremely economical.

With this company, up to about five years ago, the electric range was looked upon as something in the nature of a hobby and was never treated as a practical article which would in a very short space of time become installed in hundreds of residences, apartment houses, restaurants, etc., though this has actually taken place.

These results have been accomplished, in the first place, by co-operation with the various electrical stores in the matter of displays and careful advertising, coupled with good service and supervision,

Our average connected cooking consumer is 3.75 kw., with an average maximum demand of 2 kw., and the kilowatt-hour consumption works out at about 90 kw.-hr. monthly, which, at our present rate of 5 cents per kw.-hr., amounts to an average bill of $4.50. In taking chart readings, we find about 79 per cent of the energy used is "off-peak" and 21 per cent comes on our daily peak, our peak period being, roughly from 4 p. m. to 8 p. m. in the winter months and from 7 p. m. to 11 p. m. during the summer months.

ELECTRICAL CONTRACTORS' DEPARTMENT

IS UNDERWRITER'S INSPECTION NECESSARY IN OREGON?

BY F. D. WEBER.

[Concluded.]

As long as the municipal inspection departments are efficient and conduct their inspections on an honest basis and give a "square deal" to all parties interested, the Bureau will put forth every effort to help and aid them. But when they are influenced by "politics," the Bureau immediately assumes an independent position.

The city inspection departments are a great aid in getting the proper installations, when efficiently administered, as they are generally given police power and therefore can get immediate correction, while the Bureau can only make a penalty charge in the rate. Also the immense amount of detailed work necessary to carry on inspection in the residence district should be carried on by the municipality as a "police duty," supported by the money collected by the fee system for inspections or by money out of the general fund, because the Underwriters do not feel that they can afford to do this work without charging for same and if they do charge they have no authority to collect the fees and have no police authority to get enforcement.

(3) For several years the Bureau has made no general reinspection of Portland and only specific cases where the Bureau knew conditions were hazardous, have had their attention.

(4) Outside the city of Portland the Bureau has been making new and complete reinspections of all buildings except dwellings. The methods pursued are as follows:

(b) Notice sent owners and tenants.

(See Form letter "A" which is filled out and sent to owners and tenants of the risks inspected. The defects being

(a) Inspector goes through all the buildings.

referred to by number. Form "G" being enclosed which gives the key to the numbers at the bottom of Form letter "A." At the bottom of Form letter "A" is a "certificate of correction" which the properly authorized parties can fill out and sign when defects are corrected.)

(c) Reinspection made to see if certificate of inspection in (b) has been honestly done.

(d) Report printed on city or town and sent to managers of all companies. (See Report No. 31, Oregon City.)

(e) A second notice sent.

(f) If a municipal inspection department exists in the city where the inspection is made the Bureau endeavors to get them to condemn the defective installation in the buildings, or parts of same in question, and get correction by that means.

(g) Finally failing to get correction, the Bureau adjusts the insurance rate 5 to 25 per cent as the hazard may demand.

Form A

Sanborn Map

Block 127

Sheet 33

Map No. 1

UNDERWRITERS' EQUITABLE RATING BUREAU
559 SHERLOCK BUILDING
PORTLAND, OREGON

Page 24

Rating 56

Class A

Index 98

ELECTRICAL INSPECTION REPORT [WHEN ANSWERING REFER TO INDEX]

Mr. C. F. Smith,
Marshfield, Oregon,

Portland, Oregon,
March 1, 1914.

Dear Sir:-

Under certain circumstances an electrical defect must cause fire. This fact being well established, we feel that it is only necessary to call your attention to the following described electrical defects in order that they may be remedied. May we rely on you to notify us within a reasonable time from receipt of this letter that the defects have been corrected and made to conform to the requirements of the last edition National Electrical Code? Defects noted below have been reported as existing in the electrical equipment of your property by our Electrical Inspector in his report April 25th, 1913.

Jas. N. McCune
Secretary

City Marshfield, Owner Mr. C. F. Smith

Street 234 Main Street

Between Grant and Front Sts.,

Building Warehouse Occupants

☞ The Deficiencies noted by number at bottom of page refer to index on other side and enclosed sheet.

FILL OUT BELOW WHEN DEFICIENCIES ARE CORRECTED AND HAVE SAME PROPERLY DATED AND SIGNED AND MAIL ENTIRE SHEET TO UNDERWRITERS' EQUITABLE RATING BUREAU
P. O. BOX 745, PORTLAND, OREGON

CERTIFICATE OF CORRECTION

Marshfield, May 1st, 1913

This is to certify that the defects referred to above have been corrected as follows.

The defects in warehouse have been properly corrected.

(Signature) W. F. Powell,
Electrical Inspector.

NOTE—This certificate must be signed by the City Electrical Inspector in the city in which the risk is located, and in the absence of such an official, by some official of Electric Light Company, or Electrical Contractor who made the installation or corrected same, before being accepted by this Bureau, and is accepted only pending re-inspection by a regular Electrical Inspector of this Bureau.

DEFECTS: Warehouse:- 230:: 60 : 10.

Electrical Inspection Report; Form A.

JAMES N. McCUNE, Secretary
P. O. Box 745

TELEPHONES: Main 426
A 4207

UNDERWRITERS' EQUITABLE RATING BUREAU
559 SHERLOCK BUILDING
PORTLAND, OREGON

INDEX OF DEFICIENCIES

ADJUSTERS:
1. Unapproved cord adjusters.

ATTICS:
10. Attics not properly bored and bushed.
11. Attic inaccessible.

BOXES:
20. Lids not placed on outlet boxes.
21. Outlet boxes loose.

CONDUITS:
30. Approved rigid or flexible conduit not used.
31. Conduit not locked to cabinet (a) or fittings.
32. Conduit not properly grounded.
33. Conduits not installed on conduit.
34. Service conduit must extend to main line cutout or into cabinet if same is required.
35. Conduit installed without approved fittings.

CORDS:
60. Cord not standard.
61. Cords too long (a) or fixed other than as pendants.
62. Cords in show windows are prohibited.
63. Lamp cords in bad shape (a) or hung on metal hooks, nails or grounded materials, (b) or run through partitions.
64. Pendant cords ornamented with tinsel paper or grasses.
65. Portable lamps, (a) motors, (b) fans, or (c) fixtures not connected through reinforced cord.
66. More than one cord in a rosettes.
67. Pendant cords without knots in fittings.
68. Pendant cord attached to circuits without approved fittings.
69. Unapproved cord adjusters.
70. Cord circuits.
71. For pendant cords in wet or dusty places, use stranded tinsetry cord or packing house cord soldered direct to circuit, but supported indoor-shrouth; also weather-proof sockets must be used.
72. Two or more lights on one cord with one approved fitting.
73. Cord used for outside wiring not approved.

CLEATS:
100. Three-wire cleats are prohibited.
101. Wood cleats, staples or nails on insulators prohibited.
102. Cleats should not be concealed.
103. Cleats used on outside of building.

CABINETS:
110. Cabinets not properly made (a) or lined.
111. No doors on cabinets.
112. Cabinet doors not lined.
113. Wooden cabinets used with iron conduit.
114. Cabinet inaccessible.
115. Cabinet not dry inside.
116. Cabinet not approved by N. E. C.
117. Cabinets of approved type must be installed to enclose service switch and cutouts, (a) lightning cutouts, (b) power fuses, (c) fuses protecting motors, (c) rheostats.

CABINETS, STEEL OR IRON:
118. This Bureau will not sanction the installation of any steel or iron cabinets except those bearing the Underwriters' Label or those approved by them. (See last edition, List of Approved Electrical Fittings.)

CIRCUITS:
120. Circuits overloaded.
121. Circuits overfused.
122. Circuits with more than 16 outlets approved only on written promise that current shall not exceed 660 watts.

FITTINGS:
130. Broken fittings.
131. Fittings loose from support.
132. Unapproved fittings (as snap switch).
133. Improper use made of approved forms of fittings.
134. No support provided for fittings.

FUSES:
140. Unapproved (a) or improper use of open link fuse blocks.
141. Too many lights dependent on final fuse block.
142. Cartridge fuse block bridged with string fuse or wire.
143. Improper fuse block (a) or none at entrance.
144. Arc lamps not fused individually.
145. Fuse blocks located over or near inflammable material.
146. 125-volt fuses on 250-volt circuits.
147. Fuses too large to protect circuit.
148. Refilled (a) or (reinforced) fuses.

FLEXIBLE TUBING:
170. Flexible tubing too short at outlets.
171. Flexible tubing used through floors or in damp places.
172. Service wire flushed with flexible tubing; must be porcelain or conduit
173. Where wires are not spaced 6 inches every wire must be separately enclosed in continuous flexible tubing.
174. Porcelain and flexible tubing out of place.

FEEDERS:
200. Feeders overloaded.

FIXTURES:
210. Electric fixtures not properly installed.
211. Fixture cannopies on top of circuit wires or pendant switch wires.
212. Not properly insulated.
213. Chain fixtures in show windows are prohibited.

GROUNDING LOW-POTENTIAL CIRCUITS:
220. Low potential circuits not properly grounded on the direct current three-wire system, (a) alternating current secondary system.
221. Ground connections not made according to rules and requirements of N. E. C.

HEATERS:
235. Electric iron improperly installed.

HAZARDOUS:
238. Installation in such a hazardous condition that same should be completely re-wired.

INSULATORS:
240. Improper cannopy insulator (a) or none preventing moisture between cannopy and steel ceiling, gas pipe or grounded surfaces.
241. Cross-over tubes or insulators not properly fastened in place.

JOINTS:
260. Joints not soldered, (a) or taped, (b) or properly made.
261. No rubber tape on joints.

LAMPS:
270. Lamps hanging against woodwork.
271. Open arc lamps inside of building.
272. Miniature lamp wiring not approved.
273. Lamps must be equipped with approved lamp guards.

LOOSE:
290. Bad or loose connections at fuse blocks and switches.
291. Switches loose.

LUGS:
300. No terminal lugs used.

INDEX OF DEFICIENCIES—Cont'd

TROLLEY CURRENT:
420. Current for motor (a) or lights taken from trolley current.
421. Current for motors (a) or lights taken from trolley bus.

THEATRES AND MOVING PICTURE ESTABLISHMENTS:
440. Theatre and moving picture establishments, (a) dressing rooms, (b) auditorium, (c) stage, (d) lofts, not installed in approved conduit.
442. Moving picture theatre not installed according to standard specifications.
443. Service not according to rules and requirements of National Electrical Code.
454. Footlights, (a) borders, (b) proscenium side lights, (c) strips, (d) proscenium lights, (e) portable equipment, (f) switch board, (g) stage pockets, not installed or connected according to the National Electrical Code.

TRANSFORMERS:
460. Bell-ringing transformers not properly mounted (a) or not of approved make.
461. Sign transformer not properly mounted (a) or not of approved make.
462. Transformer cases not thoroughly grounded.

WIRE:
490. Wires of opposite polarity in contact (a) or too close together.
491. Service discontinued, but live wires still attached to building.
492. Wires not bushed at entrance.
493. Wires against or too close to grounded pipes, or improperly protected.
494. Wires not protected where liable to mechanical injury.
495. Wires in contact with outside awning (a) or with metal front or side of building.
496. Telephone or signal wires in contact with (a) or too close to light or power wires.
497. Wires not bushed (a) or bushed improperly through walls, floor or partitions.
498. Wires of opposite polarity through one hole.
499. Wires too small for current carried.
500. Wires not pitched rigidly in position (a) or loose from support.
501. Other than rubber covered wire used for concealed work.
502. Wires not properly separated in concealed work.
503. Wires not supported at sufficiently frequent intervals.
504. Solid wires used as conductors to swinging or movable lamps.
505. Wires not entering conduit properly at change from knob and tube to conduit work.
506. No fuse used where change is made in size of wire.
507. Service wires in bad shape or not properly attached to or insulated from building.
508. Wires in contact with other materials than insulators.

INDEX OF DEFICIENCIES—Cont'd

MOULDING:
310. Moulding not properly made (a) or painted, (b) or used in damp places.
311. Moulding without caspings.
312. Moulding run on grounded surfaces without backing.
313. Soft wood moulding used instead of hard wood moulding.
314. Moulding installed without tapicts.
316. Concealed moulding.

MOTORS:
320. Motor overfused.
321. Motor should be enclosed.
322. High potential motor frames not grounded, (a) conduit, (b) sheath of the lead covered cable.
323. High potential motor not installed according to National Electrical Code.
324. Motor base frames not permanently grounded, (a) not thoroughly installed.

OUTLETS:
340. Outlets not in use should be thoroughly taped up.

OUTLINE LIGHTING:
345. Method of installing "outline lighting" not approved by National Electrical Code.

PROTECTORS:
350. No protector (a) or improper protector at entrance on telephone or signal wires, (b) or protector improperly located.

RECEPTACLES:
360. Lamp receptacles with exposed lugs or contacts in show window.
361. No sub-base under snap switch (a) or receptacles.
362. Unapproved receptacles.

ROSETTES:
370. Unapproved rosettes.

RHEOSTATS:
380. Rheostat not properly mounted.

SIGNAL SYSTEMS:
385. Signal system not installed according to the National Electrical Code.

SWITCHES:
390. Improper switch (a) or none on fan or motor circuit.
391. Improper switch (a) or none at entrance point.
392. Entrance switch improperly located (a) or not readily accessible.
393. Entrance switch (a) or fuse on house side of meter.
394. Knife switch inverted (a) or located on line side of entrance fuse.
395. 120-volt switch on 220-volt circuit.
396. No sub-base under snap switch (a) or receptacles.
397. Switch and cutout must be placed in approved cabinet
398. Main service switch and fuse from the entrance of service wires to building.
399. Meter switch and cutout must be placed in cabinet.

SIGNS:
420. Electric signs not constructed and installed according to National Electrical Code.
421. Sign flashers must be installed in approved standard [illegible] cabinets.

SOCKETS:
430. Lamp sockets not bushed.
431. Keyless sockets used on unprotected cord instead of keyless sockets

SWITCH BOARDS:
440. Not constructed of slate, marble or approved equ[illegible] prior to 1913 addition [illegible] inclusive.
441. No approved ground detector.

INDEX OF DEFICIENCIES—Cont'd

509. Unsprovved wire.
511. Overlapped wires.
512. Wires not properly supported over roofs.
513. Wires in open work not properly spaced.
514. Wires held in place by tie wires on place smaller than No. 8 B. & S. gage.
515. Bare wire.
516. Wires knobbed (a) or cleated over horizontal surfaces.
517. Bond circuits and wires should be removed.
518. Cleated (a) or knobbed over grounded surfaces.
519. Wires inside of cabinets should be neatly cabled.
520. Wires must enter cabinet through openings made for that purpose only.
521. Wires should be kept free of dust accumulations in saw mills, feed mills and similar places.
522. Two wires on one single-wire knob or cleat.
523. Wires run without insulating supports such as knobs, cleats or tubes.

WIRELESS TELEGRAPH:
600. Not properly installed according to requirements of National Electrical Code.

MISCELLANEOUS:
700. Inspector was refused permission to enter risk.

NOTE—Example to illustrate use of above: Given defect, "490." This should read, "Wires of opposite polarity in contact." Had given defect been "490a" this should then be read, "Wires of opposite polarity too close together."

Form G—Key to Numbers Used on Reports.

The Bureau's efforts are not always taken in the same spirit in which they are given, as shown in the following letter from a property owner:

Dear Sirs:—As you have called me down twice for something that is not true, I will now advise you, you better employ men that have a little brains or have eyes that can see straight. I did have paper around the wire before you notified me first, but I took it off, so remind your man to look closer after this.

Gentlemen:—This defect No. 507 is all Greek to me and I am no mind-reader. If you want anybody to understand any of that dope you will have to send some key. It seems very queer that one year you are wired all O. K. and next year you are all wrong, just because there is some new junk on the market that seems better. Something is rotten.

Very resp.

To aid in this work it is necessary that the electrical contractors and workmen know the rules and requirements of the National Electrical Code. Few "laymen" can take the standard notice and understand same, therefore, it is necessary to educate the electrical contractor in many cases, which the Bureau is always willing to do if he will signify his desire to be taught.

Also the inspection department of the Bureau must maintain a consistent system of rulings and interpretations of the National Electrical Code and all persons interested in electrical installation work must be systematically advised of any change of rulings, interpretation or new rules adopted by the electrical department of this Bureau.

Therefore, there is issued annually in pamphlet form an Addenda to the National Electrical Code. Between editions of the Addenda, if it is necessary to advise the parties interested on points not covered in the National Electrical Code and Addenda, circular letters are issued which are sent to all parties on our mailing list.

Tables 3 and 4 show the work done in Oregon cities outside of Portland, during the past two years.

TABLE 3.

First Inspection. Date.		Total No. of Bldgs., Passable. A	Notices not sent, No wiring, disconnection locked. N	Total number of original notices sent. J	Total number of inspections. K	Percentage of risks passable.
St. Johns	Feb. 13-15-20, 1912.	1	6	59	66	1.5
Gresham	Feb. 28-29, 1912...	0	1	38	39	0
Hillsboro	Apr. 9-10-12, 1912.	1	11	69	81	1.2
Pendleton	June 3-9, 1912....	15	5	94	144	3.4
Ashland	May 8-9, 1912.....	12	9	70	91	13.2
Medford	May 8-9-13-14-15, 1912	22	14	91	127	17.3
Grants Pass	May 5-6, 1912.....	12	22	75	109	11
Roseburg	May 2-5, 1912.....	19	4	64	87	21.9
Cottage Grove	Aug. 9-10, 1912....	10	1	42	53	18.8
Eugene	Apr. 25-May 2, 1912	4	17	160	181	2.2
Albany	Aug. 12-14, 1912..	25	16	99	130	19.2
Salem	Mar. 14, Apr. 8, '13	69	22	107	198	34.9
Astoria	May 5-12, 1913....	61	54	162	277	22
Hood River	June 2-3, 1913....	50	3	8	61	82
The Dalles	June 9-13, 1913...	32	4	35	71	45
Marshfield	July 30-Aug 1, 1912	20	8	68	96	20.9
Coquille	Aug. 6-7, 1912.....	9	7	41	57	15.8
Bandon	Aug. 5-6, 1912.....	11	2	45	58	18.9
Myrtle Point	Aug. 7-8, 1912.....	3	9	30	42	7.1
North Bend	Aug. 4, 1912.....	12	7	27	46	26.1
Oregon City	July 10-16, 1913...	17	11	64	92	18.4
Corvallis	Aug. 5-8, 1913.....	18	12	67	97	18.5
Independence	Aug. 9-10, 1913....	5	1	24	30	16.6
McMinnville	Aug. 11-15-18, 1913	9	5	44	58	15.5
Newberg	Aug. 16-20, 1913...	17	19	64	100	17
Klamath Falls	Sept. 6-11, 1913....	52	31	55	136	38.2
Jacksonville	Sept. 15, 1913.....	20	10	7	37	54.2
Oakland	Sept. 27, 1913.....	13	13	10	36	36.1
Gold Hill	Sept. 16, 1913.....	10	7	19	36	27.7
Dallas	Nov. 19-20, 1913....	33	4	34	71	46.5
Forest Grove	Nov. 21-22, 1913...	14	8	29	52	26.9
Lebanon	Nov. 11-12, 1913....	20	11	27	58	34.5
Totals		616	354	1902	2727	

Some of the following reasons have made the electrical contracting business far from perfect and consequently a source of trouble to the inspection department:

TABLE 4.

First reinspection. Date.		No. of certs. returned O. K. B	No. of certs. returned on R. I. C	No. of cor. no cert. returned. D	No. of bldgs., rates inc. prev. E	No. of bldgs., reduced prev. inc. F	No. bldg., burned and removed. G	No. of bldgs., rates increased. H	No. of bldgs., time extended. I	Percentage of bldgs., corrected that were originally insp. after 1st reinsp. L	Percentage of bldgs., passable that were originally insp. after 1st reinsp. M
St. Johns	Oct. 3, 1912.....	19	..	18	..	..	..	19	4	62.7	63.3
Gresham	Oct. 11, 1912.....	15	10	2	..	..	..	15	19	18	18.4
Hillsboro	Oct. 18-21, 1912....	4	3	4	..	..	..	49	8	7.2	8.7
Pendleton	Oct. 23-26, 1912....	3	..	3	8	..	..	..	70	6.4	19.2
Ashland	Oct. 8, 1912.....	31	5	2	5	..	..	..	30	40	48.7
Medford	Oct. 9-11, 1912.....	17	3	7	3	..	..	..	65	23	38
Grants Pass	Oct. 13, 1912.....	36	8	11	3	3	..	..	97	52	57.4
Roseburg	Nov. 14-15, 1912...	15	4	5	10	5	1	..	52	23.8	40.9
Cottage Grove	Nov. 16, 1912.....	9	1	2	19	2	..	..	14	23.8	38.4
Eugene	Nov. 18-19-20, 1912.	67	3	2	19	4	1	..	73	40.8	42.3
Albany	Nov. 21-23, 1912....	26	..	..	12	0	4	..	61	23.1	39.1
*Salem	July 1-2, 1913.....	22	9	..	15	1	1	4	62	11.3	45.3
	Jan. 21, 1914.....										
Astoria	.....										
Hood River	.....										
The Dalles	.....										
Marshfield	Sept. 20, 1913.....	25	..	7	5	2	2	4	30	45.4	58.1
North Bend	Sept. 19, 1913.....	7	..	..	1	..	..	..	18	25.9	48.7
Bandon	Sept. 22, 1913.....	14	1	9	..	..	..	..	22	48.8	71.7
Coquille	Sept. 24, 1913.....	3	..	5	2	..	2	2	32	15.4	32.4
Myrtle Point	Sept. 24, 1913.....	7	..	2	1	..	..	1	22	30	36.3
Oregon City	Jan. 16, 1913.....	16	..	16	13	..	..	..	39	50	32

*No report made until after second reinspection.

Formulae. $$L = \frac{(B + C) + D - G}{J - G}$$

$$M = \frac{A + (B - C) + D - G}{A + J - G}$$

1. Attractiveness of the business to amateurs.
2. Carelessness and ignorance among workmen.
3. Indefinite specifications furnished by architects.
4. General disposition of public to desire cheapness.
5. Competition among the contractors themselves—"cut-throat methods."
6. "Carpet bag" competition.
7. No state restriction as to license restrictions for contractors.
8. Lack of experience within the ranks of the contractors.
9. Faulty or incorrect inspections by inspectors.
10. Lack of co-operation among contractors.
11. The rapid changes taking place in the science of electricity.
12. Lack of co-operation between architects and contractors.
13. Lack of co-operation between the jobbing trade and the electrical contractors as regards price protection.
14. Ignorance on the part of a high percentage of the electrical contractors as regards plain business methods and how to figure their legitimate profits.
15. Lack of pride in their work and business.
16. Lack of proper co-operation between central station and contractor.
17. Competition between the jobber, central stations and the electrical contractor—a family divided among themselves.

In connection with electrical construction outside of buildings, this Bureau looks to the Railway Commission of Oregon, to handle same, except in the case of fire alarm systems and specific cases where buildings are unnecessarily exposed. In some of the cities "outside electrical" ordinances are in effect and they take precedence over the railway commission's rules.

(6) The inspection department endeavors to impress upon municipal water departments and privately owned water systems used for municipal purposes the necessity of making careful electrolytic surveys, as a preventative measure in order to guard against the terrible catastrophies which might follow if municipalities are left without a water supply for domestic and fire protection. Very few cities in Oregon have more than one supply of water supplied through an iron or steel pipe, and their reservoir storage facilities are limited. Therefore, the very serious condition which might obtain if electrolysis should attack the only available source of supply. We are not aware that these suggestions have been heeded and that any of the above departments have done more than a very limited amount of investigation.

The influence of the Underwriters' electrical inspection and the National Electrical Code on the "fire loss," is borne out by all statistics on the subject and this paper has shown the methods that are employed in order to produce this efficiency

There are five (5) large cities in the United States, Philadelphia, St. Louis, Cincinnati, Baltimore, Buffalo and Milwaukee, which do not maintain separate city departments, authority being given to the Underwriters to make electrical inspections. Doubtless this method can be made the most efficient inspection known, as politics are eliminated and the Underwriters from their broad scope of operations and connections occupy an ideal position to act in this capacity.

In this age in which every one is striving for efficiency and the betterment of humanity, the public conscience has not yet been fully aroused to the crying need of a national movement to guard against fire waste.

It has been many times estimated that 90 per cent of the fires in the United States are from causes which could be prevented. Therefore, if fire prevention were taught in our public schools and the public properly educated, we would awaken the great American public to their thoughtless waste of wealth and resources.

By the "Oregonian" of February 19th, the writer notes that Superintendent of Public Instruction Churchill is providing for lessons on "fire protection." The pamphlet is comprehensive, giving the laws relating to fire prevention and regulation for school buildings.

"All teachers," says the pamphlet, "of public and private schools are required to have at least one fire drill each month in schools having an average daily attendance of fifty or more pupils; are required to instruct all pupils between the ages of six and fourteen in the dangers of fires, and to devote not less than thirty minutes each month to such instruction."

In the life of many present, we will see the U. S. Government take over the work of the Underwriters' Laboratories Inc., under the Bureau of Standards in Washington, D. C., also every state in this union will maintain a State Electrical Inspection Bureau under the general supervision of the U. S. Government and "bad electrical conditions" will be placed under the ban of the law and treated the same as "contagious diseases."

Under the guidance of the federal and state government we shall truly have "Safety First," and be compelled to "Let the Code Decide."

California electric street railways, for the year ending June 30, 1912, were operating on 2543 miles of track, carried 631,553,486 passengers with a gross revenue of $33,711,737. They operated 4938 cars, employed 16,510 employes and had only 80 fatal accidents with passengers, 14 employes and 38 other persons being killed. The total operating expenses were $20,413,317 of which $5,420,798 was spent for structure and equipment. These figures do not include the suburban electric system of the Southern Pacific Company in Alameda county and the Northwestern Pacific Railway in Marin county.

Amounts to be expended on reclamation by the Federal government during 1914 include the sum total of $21,383,412.30 for western projects in the states of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington and Wyoming. The amounts to be expended on the various features is limited and no transfer of funds will be permitted between features except after specific approval of Secretary Lane, and then only after detailed and itemized statements have been made by the projects showing the necessity or desirability for such transfers. According to the Reclamation Record, the plans are based upon certain assumptions and upon the conditions existing at the beginning of the year; therefore, it should be borne in mind by the water users that unforeseen conditions may materially change the operations as proposed.

CALIFORNIA ASSOCIATION OF ELECTRICAL INSPECTORS

Section of N. A. E. I.

C. W. Mitchell, President. Arthur Kempston.
Wm. G. Pennycook, Vice-Pres. B. C. Hill, Executive Comm.
John W. Carrell Secretary-Treasurer, 55 Fulton, San Francisco.

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correllate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

MAIN SERVICE WIRING FOR BUILDINGS—LOW VOLTAGE SYSTEMS.

By the Secretary.

Protection is the first rule of electrical construction, i.e. protection from fire and life hazards; protection by adequate insulation, by automatic safety cutouts and by mechanical arrangement. Of more importance than any other feature of installation, is the protection of main service wires, because, in addition to other things, they transmit current for the full load, however distributed in the branch circuits; because they are not, as a rule, protected by cutouts on the supply side of the main service cutout; because accidental crosses from high potential lines or leakage from transformers may cause high voltage to enter the building over these wires, in quantity or as sneak currents. To have as little wire within the building as practicable unprotected by safety fuses and to have these fuses in a place which will permit of easy access is the purpose of the National Code. The location of the main service fuses, therefore, is the most important point in main service wiring.

The general rule for the protection by fuses of all wires (other than those of branch circuits) is as follows: Automatic cutouts (safety fuses) must be placed on all wires, either overhead or underground, in the nearest readily accessible place to the point where the wires enter the building and inside the walls, and arranged to cut off the entire current from the building; must be placed at every point where a change is made in the size of the wire (unless the fuses in the larger wire will protect the smaller); must not exceed in rated capacity the allowable carrying capacity of the wire (Table No. 18, N. E. Code); must be in plain sight or enclosed in an approved cabinet and readily accessible.

To secure fuse protection for service wires in the supply system outside of the building would be ideal and the idea is continually advanced, but like many things which are ideal such protection is not very feasible. In general the only cutouts in the supply system are in the individual leads of the generators or transformers, as the case may be; many generators may be connected in multiple and for electrical and commercial reasons transformer secondaries are often banked.

In so far as service wiring is concerned buildings may be divided into four classes; as (1) those supplied from underground systems and having accessible basements; as (2) those supplied from underground systems and without basements; as (3) those supplied from overhead systems with the service wires installed underground; as (4) those supplied from pole lines by wires extending overhead to the outer wall and thence to the main service cutout.

In the first case the entrance fuses may usually be placed at or near that point where the underground tube projects through the basement wall. In the second case the most practical method is to bring the wires through the floor in conduit, with the shortest possible unprotected run, and to place the service fuses at the point of entrance. For service entrance from underground systems the general provisions are as follows: Underground conductors must be protected against moisture and mechanical injury where brought into a building and all combustible material must be kept from the immediate vicinity; must have tubes through which they enter tightly closed with asphaltum or other non-conductor, to prevent gases from entering the building through such channels; must not, if from a subway, supply more than one building.

In the third case it is common practice to install lead covered wires from the pole line to the fuses. Electrical trade conduit or punched and reamed pipe is used to enclose these wires, the tube projecting from the ground immediately under the location of the fuses.

The fourth case, the strictly overhead service, presents a more varied and difficult problem.

The service wires may enter the building through a single iron conduit. The conduit to be equipped with an approved service head.

Where the outer vertical enclosing wall of a building is fire-proof, the conduit may be embedded in the concrete or masonry and the service fuses located at a point at the first floor, such as in a tradesmen's entrance. Where the outer wall is not fire-proof (by a ruling of the Board of Fire Underwriters of the Pacific, 1910) the conduit must be run exposed on the outside of the wall to the location of the fuses, the run not to exceed a wiring distance of thirty feet. However the wires enclosed in conduit may be concealed in non-fireproof walls and the purpose of the code accomplished in an other way, i.e.—the conduit to terminate in an approved service hood located near a window of the second story and enclosing the service fuses. The hood to be installed in a manner which will permit easy inspection or replacement of the fuses. The rule would then be deemed complied with even though the literal requirement is that the fuses must be inside the walls. Ground connections for main service conduits (required by Rule 28 f, N. E. Code) should be protected from corrosion by a heavy coating of approved rust preventive. The other method is to locate the service fuses inside the building at the point where the wires actually enter the walls (as near as possible) even though this may mean a place within an upper story.

The grounding of the neutral wire of a three wire system might be well considered here, but that will be another story for a future issue.

The wireless range of shore stations is an important matter to be considered when attempting to send messages to persons on shipboard. There is no way of arriving at an average range for the stations on the Atlantic or Pacific coasts that would be reliable as the range varies so much with changing climatic and other conditions. Messages are sent much more easily at night than in the daytime and in winter than in summer, and the range under favorable conditions at midnight during midwinter is said to be several hundred per cent better than at noon in midsummer. Each station has a normal range assigned to it, and this range is set forth not only for the coast stations, but for those on every ship equipped with wireless as well, in the bulletins of the International Bureau at Berne. These normal ranges are given in most cases from 100 to 400 nautical miles, but some are lower and several higher than this. The range of ship stations is ordinarily from 100 to 200 miles.

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POWER AND GAS

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Lest We Forget

Twenty years ago Western business was at low ebb. The boom of 1887 had burst and the blight of 1893 had fallen upon the entire country. Heroic measures were necessary.

A few courageous men of vision rose to the emergency. By their indomitable energy and unbounded enthusiasm they fired the faith of Eastern investors in the integrity of the West and the great natural resources with which nature had endowed it. They expended their creative ability in constructive endeavor, poured forth money unstintingly, and built up a prosperity unparalleled in the world's history.

Consider the facts of the electrical growth alone. Power was transmitted at undreamed of voltages over unheard of distances. Its abundance and cheapness made new industries possible, and today this handful of people on the Pacific slope are pre-eminent in the use of electricity, the greatest civilizing agent the world has known. One seventeenth of this country's population is using nearly one-fourth of the entire generating capacity, and contributing one-seventh the aggregate income of the electric lighting industry. On an average, every person in the West uses 527 kw. hours yearly, and pays $7.50 for light and power, as compared to the 99 kw.-hour consumption and the $3 contribution of the population East of the Rockies.

An Appeal to Reason

Sensationalism is now trying to stir up public sentiment against the men who have done these things: men who made possible the transportation, light and power facilities, upon which city growth is so dependent, this being done long before these utilities were commercially profitable. Many of these proposals amount to virtual confiscation of property, in order that politicians may ride into office on the hobby of public ownership.

While several examples might be cited, these remarks are particularly applicable to Los Angeles at present. Although this city has already been bonded for over $35,000,000, most of which has been expended upon the Los Angeles aqueduct, another issue of $6,500,000 is to be voted upon next week. Of this, one issue calls for $1,250,000, to complete the hydroelectric power plants for which $3,500,000 was voted in 1910, and another calls for $5,250,000 to build or acquire a power distributing system. Other bonds aggregating $30,000,000, with these, are also under consideration for water, sewer, park and harbor improvements. Some difference of opinion exists as to the limit of bonded indebtedness which the city may yet assume, but the most extreme estimate is slightly in excess of $20,000,000, which shows how close to the danger line the city is steering in bonding itself for duplicate electric utilities now supplied by private enterprise.

The average citizen does not realize that public utilities are as important an asset to his city as they are to the owners, and that if improvements are to be made, the investment must be attractive instead of repulsive to capital. The safety of any investment does not lie in its special class, whether municipal, industrial or public utility, but in the security back of it Each new municipal bond issue weakens the security and the credit of a community, so that when it is

necessary to raise money for needed conveniences, cities may have as much difficulty in borrowing as do individuals.

It is also hard for non-property owners to understand that they pay their share of this tax for bonding. Taxes increase the cost of production, the cost of distribution, the cost of doing business, and the scale of rents. The wage-earner, who has been brought up in the belief that only the rich pay the taxes, really pays indirectly a larger part of his income than those who pay direct money to the tax collector. Under municipal ownership of public utilities, the municipality pays no taxes, and consequently the added burden must be borne by the citizens instead. Higher taxes follow bonds as surely as death follows life.

Furthermore, there is no immediate necessity for issuing these bonds for the distribution system, as the electric companies have offered either to buy the aqueduct power or to lease their distributing lines to the city. In either case, the rates would be fixed by the state railroad commission, and the municipality would be in a position to sell power at an assured income instead of bonds at an assured outgo.

Gratitude Remembers

Finally if this calm statement of fact does not appeal to the reason of the citizen, his sense of loyalty should certainly cause him to vote against such bonds. Loyalty above all else cannot be one-sided. It is as necessary for the West to be loyal to capital as for capital to be loyal to the West. Are they loyal to those who have made possible these many advantages when property is depreciated? Are they helping those who have helped them? While municipal ownership may be inevitable, should it not be accomplished by evolution instead of revolution? If no other argument prevails, reason and sentiment would both dictate that gratitude—cynically defined as "a lively appreciation of favors yet to come"—compel the defeat of these bonds.

Safety First in Mine Haulage

Though underground and out of sight, invention and applied invention—which is progress—have not ignored the mines. This was emphasized at the recent meeting of the electrical section of the Nevada Industrial Safety Conference, held at Reno, Nevada, during the past week, when the subject of electric mine haulage was discussed from many different viewpoints.

Haulage in mines has differed widely in but a comparatively short period as to the means of propulsion employed, but improvements have latterly been along the line of the method of utilizing electricity for that purpose.

In Justin McCarthy's "History of Our Own Times," the author describes how that less than seventy-five years since, women were employed in the mines of "Merrie England" for the purpose of hauling cars; their harness a chain passed between trousered legs and fastened to the bare waist. These women lived lives of degradation, and legislation soon compelled the use of ponies in their stead. Born in the mines, and not knowing the light, these ponies were blind.

To-day mine haulage in this country is by mules or by the still more modern use of compressed air or electricity, and the tunnels are often well illuminated with diffuse electric light.

This is the short history of there and here and of changed conditions in but a few years.

And electricity, the last in adoption, has become first in safety.

It is more efficient and more humane than the old English method, and is naturally cleaner and more reliable than the mule, over which a saving is shown in one stated instance, of no less than one-third.

Before electricity has entirely displaced the mule, some progressive companies are already changing their existing and comparatively new electrical systems to others considered by them more advantageous, economical and safe.

For, like the mule, electricity has a kick if not used rightly.

The object of the meeting was to aid in the determination of correct practice in electric mine haulage.

Custom, age of installation and preference, are factors conducive to variation and one of the important points brought out is that there is at present no standard practice.

Those best informed on these matters are apparently not sufficiently well informed as to the scope, possibilities and types of apparatus available. For example, opposite opinions were expressed as to the advantages of alternating and direct current systems and apparatus, which condition manufacturers would do well to consider.

One important development was that safety is largely a matter of efficiency for an item as seemingly remote as the best type of car bearing might make available the means of more safe mine operation—that is to say, of fewer accidents and in electric mine haulage, Safety First.

Opportunity Defined

Opportunity is usually considered a circumstance; a favorable or advantageous season; or, in a word, something closely akin to chance. But there is a different definition which rightly removes the element of chance or uncertainty—one which is more just—and although it has not yet found its way into the dictionaries, is none the less correct:

Opportunity consists in the improvement of human service, conditions, or environment.

This definition, instead of allowing you to rust while waiting for opportunity to turn up, urges you to brighten up while evolving opportunities. It calls for preparation, vigilance, tact, and a daring aggressiveness which will carry proposed projects through to a successful issue.

You cannot improve that about which you know nothing. Other things being equal then, they have most opportunity who possess the most useful knowledge.

Opportunity will crowd you if you are prepared, for opportunity is eternally existent everywhere, and is every man's up to the limit of his capabilities.

The world of electrical interests needs those who can grasp opportunity, for the improvement which follows makes for increased business.

Improve your opportunities.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

J. Guilbert, of Guilbert Bros., electrical contractors, San Jose, is at San Francisco.

Mortimer Fleishhacker, president Great Western Power Company, has returned to San Francisco from New York.

J. O. Jensen, secretary and manager Los Gatos Telephone Company, was at San Francisco during the past week.

R. B. Fairly, representing Kellogg Switchboard & Supply Company in the Pacific Northwest is a San Francisco visitor.

E. S. Berdine, representing the Gleason, Tiebout Glass Company, has returned to San Francisco from Southern California.

L. E. Voyer is now illuminating engineer, Edison Lamp Works of General Electric Company in the San Francisco office.

Arch. M. Jones of Jno. A. Roebling Sons' Company has been transferred from San Francisco to the Seattle office of the company.

H. D. Brainard, sales manager of the Seattle office of the Western Electric Company, spent the past week at Portland, Oregon.

L. H. Baldwin, representing Kellogg Switchboard & Supply Company at Los Angeles, is making a business trip throughout New Mexico and Arizona.

E. A. Wilcox, Twelfth Mars of the Jovian Order, was a visitor at Salt Lake, having come from Twin Falls, Idaho, to assist Statesman Jones in his Rejuvenation.

Hal Lauritzen, manager Western Division Holophane Works of General Electric Company, is at Los Angeles and expects to remain in that city for about two weeks.

L. M. Cargo, district manager of the Westinghouse Electric & Manufacturing Company at Denver is at Salt Lake City on his regular trip of inspection over the territory.

A. G. Wishon, general manager San Joaquin Light & Power Company, and **G. H. Newlin**, purchasing agent of the company were at San Francisco during the past week.

W. R. Lyall of the D. & W. Fuse Company has returned to San Francisco, having made an extensive trip through the Pacific Northwest and the country east to Salt Lake City.

S. A. Chase, special representative of the Westinghouse Company, recently from Pittsburg, Pennsylvania, is at San Francisco and will visit other coast cities before returning east.

R. Q. Cleavenger, representative of the Phoenix Glass Company, New York, is at Salt Lake City. He was a visitor at the Utah Electric Club luncheon and made a few well chosen remarks.

Henry F. Holland and **Arthur L. Faber** went from Salt Lake City to Pocatello on the 18th of April to assist Statesman Brokaw in the Jovian Rejuvenation held in that city on the above date.

P. B. Sawyer, general manager Utah Power & Light Company, has been called to New York City in connection with the retirement of the short time notes of his company which is now in progress.

H. D. Currier has been appointed chief engineer of the Kellogg Switchboard & Supply Company, Chicago, Ill., and has complete charge of the company's engineering department, laboratories and engineering inspection.

J. B. Balcomb is executive engineer in charge of construction of the new hydroelectric power plant of the Wild Horse Power & Milling Company, Andrews, Ore., and will later take charge of the operation of the plant.

Newcomb Carlton has been elected president of the Western Union Telegraph Company in place of **Theodore N. Vail**, who remains president of the American Telephone & Telegraph Company from which the Western Union was recently divorced.

J. M. Smith, assistant to manager, Holophane Works of General Electric Company, Cleveland, Ohio, who has been visiting Pacific Coast cities, is now at Portland, Oregon. Accompanied by **J. O. Presbey**, representative of the company in that territory, he will visit Seattle; also Salt Lake City and Denver on his way East.

J. G. Scrugham, University of Nevada, Reno, Nev., was appointed committee chairman of the electrical section of the Nevada Industrial Safety Conference for 1914. The following were appointed directors: **E. D. Brown**, superintendent Truckee River General Electric Company; **W. N. Chatfield**, manager Pacific Power Company; **H. S. G. Hurlburt**, superintendent Pacific Power Company; **B. G. McBride**, manager Elko-Lamoille Power Company; **L. W. Crehore**, electrcal engineer Fallon city plant; **G. L. Perrin**, chief electrician Nevada Hills Mining Company; **Joseph Beane**, electrical superintendent U. S. reclamation service; **R. E. Middagh**, engineer Nevada Con. Copper Company; **Thos. G. True**, chief electrician Reno P. L. & W. Company; **T. R. Landsborough**, electrical engineer Tonopah Extension Company; **J. K. Poe**, electrical superintendent Goldfield Consolidated Company; **A. D. Voss**, electrical engineer Buckskin Mines Company; **F. B. Mechling**, manager Nevada-California Power Company; **R. R. Layman**, district superintendent Nevada-California Power Company; **W. K. Freudenberger** and **C. S. Young**, superintendent Lovelock Power Company. **F. O. Broili**, Nevada Machinery & Electrical Company, was appointed committee secretary. This committee is charged with the duty of recommending electrical standards for Nevada.

MEETING NOTICES.

Seattle Jovian League.

The Seattle Jovians have decided to suspend their weekly meetings until next September, this action being confirmed at a recent meeting of the executive committee.

Seattle Engineers' Club.

The members met at luncheon on Thursday, April 23d, at the College Club, and afterwards C. P. Tatro, manager of the Marine Wood Preservative Company of Seattle, gave an interesting talk on "Preservation of Steel and Wood for Submarine Construction in Both Salt and Fresh Water."

Los Angeles Section, A. I. E. E.

At the next regular meeting of the Los Angeles Section of the A. I. E. E., a paper will be read by Julian Adams on "Railway Substation Operation." The meeting will be held on April 28th at Blanchard Hall. An announcement of the Pacific Coast Convention to be held at Spokane, Wash., in September will be made at that time.

San Francisco Electrical Development and Jovian League.

Members of the league met on Tuesday, April 28th, at the Hof Brau and after luncheon listened with enjoyment to the breezy banter and pleasant reminiscences of the "Perripatetic Peregrinations" of Joe Thompson of the Pacific Electric Manufacturing Company. There was nothing else to do at the close, and after an unusually hearty vote of thanks had been tendered, but to appoint Mr. Thompson, Stentor of the Jovian Order and this was done with the unanimous and hearty approval of all present.

Alameda County Electrical Development League.

The regular luncheon meeting was held at a cafe in Oakland on April 25th, Mr. Geo. Furniss presiding. After some discussion it was decided to appoint a grievance com-

mittee to investigate controversies of various kinds. A paper on "Figuring Profits" was then read by Mr. A. H. Halloran. As an aftermath of the discussion which ensued it was decided to devote the May meeting to a consideration of various cost estimates on an electrical installation for a five room cottage to be submitted by contractors. As usual the meeting was well attended and of great value to all members.

San Francisco Section A. S. M. E.

A meeting of this section of the American Society of Mechanical Engineers will be held at the rooms of the Engineers' Club, Hotel Sutter, San Francisco, on May 6th, at 8 p. m. The subject of the evening will be the "Stationary Diesel Engine," the paper being read by Herbert Haas. Mr. Haas' discussion will be illustrated by lantern slides. Following the reading of the paper a general discussion will be held in which all present are invited to participate. Members may extend an invitation to be present to any friend who may be interested. The executive committee hopes that as many as possible may take advantage of this opportunity to familiarize themselves with this interesting type of prime mover that seems destined to exert a strong influence upon Pacific Coast power conditions.

The Jovian Electrical League of Southern California.

The weekly luncheon at Christopher's on Wednesday, April 22d, was attended by about 100. Joseph W. Ford, assistant district attorney, gave a talk on "The Duties and Responsibilities of a District Attorney." Mr. Ford, who is well-known in connection with the prosecution of the men who were found guilty of the Los Angeles Times outrage, eloquently portrayed the problems confronting a prosecuting officer and the various elements which enter into a case before the same can be faithfully prosecuted. His exposition of the theme was a revelation to his hearers and no doubt heightened their respect for the speaker and the profession which he represents. The chairman of the day was Harry W. Harrison. A League dance was held at Frazier's Million Dollar Pier, Ocean Park, on Wednesday evening, April 29th. A very successful rejuvenation is promised for Friday evening, May 15th, at the old Clark Hotel, as over 30 "victims" have already been secured. There is great rivalry among the members for the handsome prizes offered by the League for the men securing the largest number of candidates.

Jovian Rejuvenation at Salt Lake City.

A highly successful Rejuvenation of the Jovian Order was held in Odd Fellows' Hall on Tuesday, April 21st, under the direction of John C. Jones, Statesman for Utah. This rejuvenation formed the concluding exercises of the two days' session of the district managers and commercial representatives of the Utah Power & Light Company, and most of the initiates were obtained from the ranks of these load builders. The initiatory exercises were handled by the following degree team:

Jupiter, Stanley S. Stevens.	Apollo, F. H. Barber.
Neptune, E. K. Bacon.	Pluto, R. Ackerman.
Vulcan, H. F. Holland.	Mars, Bayard W. Mendenhall.
Hercules, W. C. Wurfel.	Avrenim, J. B. Ambler.

Twenty-one candidates were initiated into the order. At the conclusion of the rejuvenation a Joviation and banquet were held at the Hotel Utah, H. T. Plumb acting as toastmaster. The following toasts were responded to: Manufacturers, Jobbers, Central Stations and the Jovian Order, Bayard W. Mendenhall; The National Organization, E. A. Wilcox; Jovianism, W. C. Wurfel; Jovian Philosophy, H. P. Holland; Reminiscences, L. M. Cargo.

Utah Power & Light Company Conference.

The first "Get Together" conference of the New Business Department of the Utah Power & Light Company was held in Salt Lake City April 20th and 21st. This company during the past eighteen months has taken over the electric lighting and power systems of a majority of the towns in southern Idaho and in northern and central Utah, and the conference was called for the purpose of bringing the various representatives of the company, particularly the new business department, into a closer relationship with the general office and with each other. About thirty representatives from towns outside of Salt Lake City attended the meetings, in addition to all employes in the head office interested in the matters under discussion.

At the dinner given by the company to its representatives at the Hotel Utah on Monday evening, the principal officers of all of the central station companies in this district, and representatives of the manufacturers, jobbers and electrical contractors doing business in territories served by the Utah Power & Light Company were present as guests.

The program of the two days' conference follows:

Monday.—Purpose and Plan of Meeting, W. R. Putnam, commercial manager; The Utah Power & Light Company, P. B. Sawyer, general manager; Power Department, L. Brandenburger, in charge; Mining Power Loads, R. Timmerman, Bingham; Sundry Power, C. W. Cates, Idaho Falls; Pumping for House Pressure System, Electric Refrigeration Loads, P. H. Craven, American Fork; National Electric Light Association Membership, S. R. Inch, general superintendent; Discussion of Accounting and Special Investigation—Department Forms and Routine, G. B. Thomas, V. Y. Davoud; Advertising, L. S. Gillham.

Tuesday.—Irrigation Department, W. H. Trask, Jr.; Small Irrigation Loads, T. A. Phillips, Layton; Centrifugal Pump Developments, C. H. Hills, Worthington Pump Company; Single-Phase or Three-Phase Motors—Where to Be Used, Markham Cheever; Lighting and Appliance Department, J. F. Derge; Sign and Window Lighting, C. W. Kendall, Ogden, and W. G. King, Electric Sign Service Company; Electric Cooking, M. R. Lott, Provo; General Improvements in Lighting Installations, Mr. Robinson, National X-Ray Company; Recent Developments in Street Lighting Systems, A. P. Merrill Provo; Purchasing Department A. D. Smith, purchasing agent.

NEWS OF THE P. P. I. E.

Railway passenger agents from all the principal lines of the United States have just finished a meeting in San Francisco at which the rates for the exposition were agreed upon. The exceptional rate of one way fare for the round trip was announced after several days' deliberation and this affords the best opportunity from an economic standpoint for those who have long been planning a western trip. The railroads are expecting to carry a million people from the eastern states to the exposition in 1915. The American Association of Traveling Passenger Agents has also selected San Francisco for the meeting November 9, 10 11 and 12, 1914.

The executive committee of the Traveling Passenger Agents visited the exposition grounds recently and, in the words of the secretary, Elliott T. Monett, "everybody was simply dumbfounded upon finding 70 per cent of the buildings completed, which without doubt when completed will be the most beautiful picture ever witnessed in this or any other country."

The greatest feature of the new rates for 1915 is that they are good for 90 days and will be on sale at any station on any day.

The first of the great wooden ribs that are to form the dome of the Palace of Manufactures was set in place on April 1st. This dome is the last to be completed of all the exhibit structures of the same material and the delay was caused by the storm of last February, which blew down parts of the structure left over night without more than temporary supports.

The demands for space in human welfare exhibits to be placed in the Palace of Social Economy and Education has been so heavy that arrangements are already being made for the overflow. Nearly three-quarters of an acre more will be necessary to provide room for the exhibits that have been culled from those for which application for space was made.

In addition to the temporary fire station already installed on the exposition grounds with a complement of men, horses and apparatus, a city fire tug has been assigned to the exposition and a wharf is being built especially for it along the esplanade of the Marina.

The Panama-Pacific International Exposition from September 20 to 25, 1915, will be the meeting place of the

largest body of distinguished engineers ever assembled in one place and Colonel George W. Goethals will preside over the first international engineering congress. As Colonel Goethals will be the hero of the achievement which the exposition is to commemorate this meeting will be one of the most important that will be held in San Francisco in the time of the exposition.

RAILROAD COMMISSION OF OREGON.

On May 4th at 10:30 a. m. at the court house, Portland, Oregon, there will be a continuation of the hearings in regard to the application of the United Railways Company for authority to increase passenger fares, and the Tualatin Valley Transportation Association vs. Oregon Electric and United Railways Company involving fares on the Oregon electric lines.

IDAHO PUBLIC UTILITIES COMMISSION.

The commission ordered that the Idaho Power & Light Company and the Great Shoshone & Twin Falls Water Power Company put into effect the following schedule of rates to be charged by them respectively for electrical current furnished at all points and localities east of Mountain Home, and including Mountain Home. Commercial and residence lighting:

First 20 kw.-hr., 09 per kw.-hr.
Next 30 kw.-hr., .08 per kw.-hr.
Next 40 kw.-hr., .07 per kw.-hr.
Next 50 kw.-hr., .06 per kw.-hr.
Next 100 kw.-hr., .05 per kw.-hr.
Next 200 kw.-hr., .04 per kw.-hr.
Next 500 kw.-hr., .03 per kw.-hr.
All additional kw.-hr., .02 per kw.-hr.

A domestic and commercial cooking rate was also ordered but was later cancelled.

The above schedule was also ordered effective for American Falls, Pocatello, Fort Hall and Blackfoot, all of which are served by the Southern Idaho Water & Power Company.

The Hailey Electric Company engaged in business in the vicinity of Hailey, filed with the commission a schedule of its rates and charges for electric current, which were found to be similar to the rates and charges for such service heretofore established by the predecessor in interest of said electric company and ordered approved.

A rehearing in the case of the Southern Idaho Water Company vs. Beaver River Power Company was refused by the commission.

On complaint brought by the Great Shoshone & Twin Falls Water Power Company against the Idaho Power & Light Company and the Beaver River Power Company, the commission ordered the defendant companies to discontinue the construction of a distribution system commenced, in the city of Buhl, in contravention of the laws of the state.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The commission has rendered a decision in which it authorizes the Sunset Telephone & Telegraph Company to sell its system at Tulare, Tulare county, to the Tulare Home Telephone & Telegraph Company.

Reclamation District No. 551, embracing 9000 acres of swamp land in the vicinity of Vorden, Sacramento county, has filed a complaint with the commission against the Great Western Power Company in which the district claims that the rates of the Great Western Power Company for 50 h.p. motors or over, within the territory of the reclamation district, are unreasonable and unjust.

The Calistoga Electric Company has filed an application with the railroad commission asking for a rehearing of the application of the Napa Valley Electric Company which was granted a certificate of public convenience and necessity March 31st by the commission to serve territory adjacent to the town of Calistoga.

The United Railroads of San Francisco, E. H. Rollins and Sons and Union Trust Company of San Francisco have filed an application with the commission asking for authority to execute a car equipment trust agreement. Under the proposed agreement the United Railroads will purchase 65 new cars for use in San Francisco at an aggregate sum of $365,000.

The Happy Valley Land & Water Company has applied to the commission for authority to issue 1000 shares of its capital stock to be sold at the par value of $10 per share. Funds to be derived from the sale of stock will be applied to liquidating indebtedness and to the construction of a dam to impound water in Happy Valley, Shasta county.

The Modoc County Irrigation Company has filed an application with the commission asking for authority to mortgage its property in a sum not to exceed $750,000 and to issue bonds for the purpose of constructing its irrigation system at Cowhead Lake in the northern part of Modoc county. The company anticipates placing 150,000 acres of arable land under its ditch system.

The Glendale & Eagle Rock Railway Company has filed a supplemental application with the commission, asking for authority to issue first mortgage 15 year 6 per cent bonds in the sum of $122,801.55. The company had applied to the commission for an order authorizing an issue of $150,000 and on April 11th was authorized to issue $59,589.55 only. The supplemental application is based upon a schedule of additional physical equipment labor charges and outstanding notes.

The Long Beach Consolidated Gas Company has filed an application with the commission asking for authority to issue 1400 shares of its preferred capital stock at the par value of $100 per share at not less than 80, and for authority to sell 60 of its first mortgage 6 per cent gold bonds at a price not less than 95. Of the funds to be derived from such sales, the applicant wishes to apply $108,000 to outstanding notes and the balance to accounts payable estimated at $69,131.31.

The Midland Counties Public Service Corporation of Los Angeles, formerly known as the Coalinga Water & Electric Company, has filed an application with the commission, asking for authority to extend the date of maturity one year on notes in the aggregate sum of approximately $150,000.

The Nevada County Narrow Gauge Railroad Company has filed an application with the commission for a rehearing in the matter of ascertaining the value of the property of the company. The company urges in its application that the present value is equal to the reproduction value.

ARIZONA CORPORATION COMMISSION.

The commission ordered that the Arizona Copper Company, Ltd., Clifton and Morenci, Arizona, make a monthly minimum charge of $1.00 per meter for electricity, but provided that the minimum absorb such quantities of electricity as may be consumed under regular schedule rates up to the full amount of the minimum charge.

The Nogales Electric Light, Ice & Water Company, Nogales, Arizona, was also given permission to make a similar minimum charge to its consumers; also the Flagstaff Electric Light Company, Flagstaff, Arizona, and the Desert Power & Water Company, Kingman, Arizona.

On application of the Yuma Gas Company, Yuma, Arizona, for approval, the rates submitted were approved, to become effective April 1, 1914, as follows:

First 600 cu. ft. or less, $1.00 per month.
First 10,000 cu. ft., $1.75 per M. per month.
Next 20,000 cu. ft., $1.50 per M. per month.
All in excess of 30,000 cu. ft., $1.25 per M. per month.

OREGON RAILROAD COMMISSION.

Annual Report for 1913.

Regulation of public utilities, together with steady growth of railroad business, has increased the work of the Railroad Commission of Oregon just 274 per cent in one year, measured by the volume of formal complaints handled. This is one of the features disclosed by the annual report of the commission for the year ending December 15, 1913, which has just been made public.

It is stated that 226 utility companies have been listed under the jurisdiction of the commission and considerable progress made in the valuation of several of the larger utilities, this being necessary before rates are fixed. The report brings the narrative of work performed down to December 15, 1913, and valuation investigations stated to be nearing completion are those of the Portland Railway, Light & Power Company, Coos Bay Water Company, St. Johns Water Works & Lighting Company, Rogue River Water Company of Grants Pass, Home Telephone & Telegraph Company of Southern Oregon, and the Salem Water, Light & Power Company. Water plant valuation is under way at Dallas, also valuation of the Pacific Telephone & Telegraph Company's plant at Oregon City, and it is stated that substantial reductions have been secured in light and power rates, without necessity for formal proceedings, in Dallas, Monmouth, Independence, Junction City, Corvallis and other towns of the Williamette Valley.

Concerning the business handled by the commission during the year, the report says:

"Listing of the complaints filed shows 352 informal railroad complaints compared with 301 filed in 1912. The number of formal railroad matters filed was 59, compared with 47 the previous years. In the utilities branch, 183 informal complaints and 70 formal matters were docketed. The increase in total number of formal complaints, which in most cases have necessitated hearings, from 47 in 1912 to 129 in 1913, or 274 per cent, indicates in a degree the expansion of the commission's work."

Disposition made of these complaints is reported in detail, and the distinction between formal and informal procedure explained, the former being matters in which hearings are required to thrash out questions of rates or service, the informal being taken up for adjustment on a mere statement of the grievance. Of the informal matters, 251 out of 370 of those relating to railroads were satisfactorily settled, 27 are pending, 22 were dropped because of lack of jurisdiction. Of the utility matters handled in like manner, 90 out of 153 are reported settled, 10 transferred, 5 pending, and 35 dropped because plaintiffs did not wish to go further.

"Valuation of the physical property of the Portland Railway, Light & Power Company," says the report, "is the largest single task ever undertaken by the commission. The rates charged and service rendered by this company directly affect not less than one-third of the people of the state, and it is only by a comprehensive investigation that any complaints arising in connection with the rates and service of this company can be placed on a basis for equitable and satisfactory adjustment."

Other topics covered by the report, aside from the statistical portion, are cases that have been appealed to the courts, proceedings before the Interstate Commerce Commission, manner of handling complaints, grade crossing problems, demurrage rules, railroad valuation, improvement of Corvallis & Eastern railroad between Corvallis and Yaquina. train delay reports, suspension of railroad tariffs, accident investigations, scope of work under the utilities act, methods of utility valuation, telephone and water rate cases, accounting department work, and commission merchant's act.

BOOK REVIEWS.

Incandescent Electric Lamps and Their Application. By Daniel H. Oglay; 107 pp.; 5x7½ in.; cloth bound. Published by Longmans, Green & Company, and for sale by Technical Book Shop, Rialto Building, San Francisco. Price, 80 cents.

This book which is of Longmans' Technical Handicraft Series, is written for the general reader and constitutes a comprehensive treatise of the subject. It carries the reader from the production of light to its efficient utilization, and on the way, deals with photometry, light distribution, calculation of illumination, the eye and the principles of vision, and lighting systems. The illustrations are also very complete.

Insulation and Design of Electrical Windings. By A. P. M. Fleming, M. I. E. E. and R. Johnson, A. M. I. E. E.; 224 pp.; 6x9 in.; cloth bound. Published by Longmans, Green & Company, and for sale by Technical Book Shop, Rialto Building, San Francisco. Price, $2.25.

In this treatise, which is fully illustrated, the authors have endeavored to set forth the underlying principles and methods whereby the design of insulation can be carried out with precision instead of by the process of trial and error which has apparently been generally used in the past for the solution of insulation problems. Insulation constitutes the most vulnerable part of electrical machinery and this work should have a wide and important application and use.

High and Low Tension Switchgear Design. By A. G. Collis, A. M. I. E. E.; 218 pp.; size 6x9 in.; cloth bound. Published by D. Van Nostrand Company, and for sale by the Technical Book Shop, Rialto Bldg., San Francisco. Price $3.50.

This work, which is profusely illustrated and contains sufficient line diagrams for a further explication of the text, also includes a number of oscillograph records which are unique and believed, by the author, to be the first published records of their kind. It consists of the result of researches made with the object of obtaining accurate data as to the effects caused by opening and closing circuits with various types of electrical apparatus. It goes into the main elements of design both of alternating and direct current switchgear, being divided into two parts for that purpose. Engineers and artisans in all departments of electrical engineering practice will find this book an invaluable aid in acquiring a better knowledge of this most important part of electrical equipment.

The Efficient Kitchen. By G. B. Child; 242 pages, 5x8. Published by McBride, Nast & Co., New York City.

While it is not the custom of this journal to review miscellaneous works one fault in this otherwise excellent text should be brought to the attention of electrical men, so that correction may be made in future editions of this and similar books. In the 242 pages only six references have been made to electric lighting and cooking, and several of these are not in accord with recognized facts as the following quotations show: "One bulb centrally located will give ample light for a small kitchen"; "in certain parts of England electricty for cooking purposes has been offered at a rate of one cent per kilowatt hour. This is unheard of in the United States, where ten cents is an average rate and twelve or fifteen not at all unusual." Misleading statements also appear regarding the high cost of electric cooking utensils, washing machines and no reference is made to the many small motor appliances now found in the really efficient kitchen.

PUBLICATIONS RECEIVED.

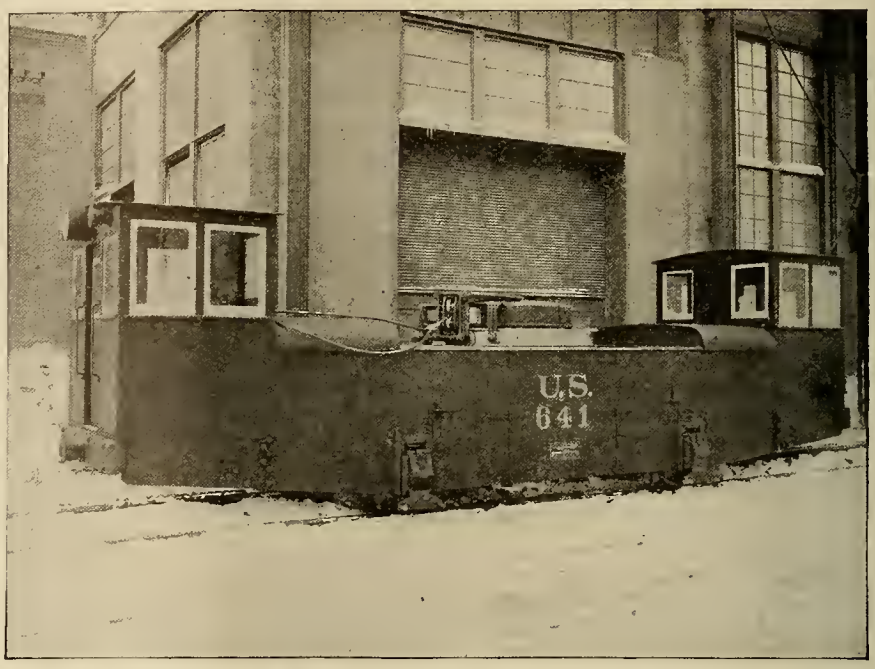
The fifth edition of the Western Electric Company's copyrighted bulletin "How to Figure Illumination—Also a Complete Catalog of Sunbeam Mazda Lamps" is just off the press and is being distributed. This bulletin gives information for planning the illumination of interiors.

INDUSTRIAL

PANAMA CANAL ELECTRIC TOWING LOCOMOTIVES.

The first electric towing locomotives for hauling vessels through the locks of the Panama Canal are now being delivered at the isthmus. In all forty of these "electric mules" are being built by the General Electric Company. The machines weigh 82,500 lb.; measure 32 ft. 2½ in. long by 8 ft. wide by 9 ft. 3 in., the greatest height over the cabs; have an available tractive effort as high as 47,500 lb. and a windlass rope pull of 25,000 lb,, and four of them, two on each side, will ordinarily propel steamships through the locks. Sometimes six engines will be needed to handle extra large vessels; in every case two astern, acting as a brake on the ship's movements, will give direction to her course. No vessel will be allowed to enter the locks and go through on her own power.

The locomotive is built up of cast steel side and end frames, cross ties axles with wheels in accordance with MCB standards. The entire frame is supported from journal boxes of the regular railway type by means of coiled springs. The sides and top of the body are enclosed by sheet iron covers which fit in place and are very easily removable. At each end are enclosed cabs so that the locomotive may be operated from either end.



Type of Electric Locomotive for Towing Ships Through the Panama Canal Locks.

The locomotive is propelled by means of a rack rail while towing and while going up or down the steep grades from one level to another at a speed of 2 miles per hr. While running idle or on return tracks, the speed is changed to 5 miles per hr. and the machine is propelled by the regular traction method, the rack pinion being entirely released. This change is effected by manually-operated clutches located in the gear mechanism. The locomotive is driven by two 75 hp. totally enclosed motors of the mill type, one being direct connected through reduction gearing to each axle. Three-phase, 25 cycle, 220 volt current is used and is collected by contact plows. The motor and traction gearing is mounted on a common baseplate, which in turn is mounted on a driving axle and spring suspended to the locomotive frame the same as in regular railway practice.

In the center of the locomotive is located a vertical windlass with drum, the capacity of which is 800 ft. of 1 in. steel hawser cable. The windlass cable is handled by two 20 h.p. motors, also totally enclosed and of the mill type. One is geared for a rope speed of 12 ft. per minute at a pull up to 25,000 lb. at 2 ft. radius, and its function is to adjust the position of the ship for anchor or while being towed through the locks. The other motor is geared for a rope speed of 200 ft. per minute at 2 ft. radius, and its duty is to take up slack or pay out cable or wind in any part of the entire length of cable as may be required.

The traction motors as well as the windlass motors are controlled from either cab. In other words, the control equipment is duplicated. The two traction motors are operated by one master controller and contactors forward and reverse; while the windlass motors are operated by a reversible drum controller, and the clutch on the main vertical shaft by a solenoid.

TRADE NOTES.

The complete lighting fixture equipment of the Hinds-Rolph Building, San Francisco, has been made by the Mohrlite Company, San Francisco. It comprises 79 commercial type Mohrlite units.

M. J. Walsh & Company, of Portland, Oregon, have secured the electrical contract for the new apartment house being constructed at Nineteenth and Lovejoy streets, Portland, Oregon. The building is owned by the Royal Arms Company.

HIGH POWER LAMP STREET LIGHTING.



The natural tendency at the present time in street lighting is toward a single light standard having a globe of ornamental design. The unit to meet these requirements, however, must also be of high efficiency.

Such a unit has recently been developed by the Holophane Works of General Electric Company, Cleveland, and is shown mounted on a standard in the accompanying illustration. The unit consists of two pieces. The upper part is made of Pyro, a dense opal glass, and the lower of a light density opal glass or crystal, roughed inside glass. As a result the upper portion acts as a reflector, throwing a considerable proportion of the light on the street surface, where it becomes useful in performing the function of street lighting. The unit is designed for use with the new high efficiency Mazda lamps of either the multiple or series type. With a 750-watt multiple Mazda lamp the maximum candle-power is 950 at an angle of about 65 degrees.

The ornamental appearance of this unit is very pleasing. This, together with its high efficiency of light distribution, makes it ideal for business district and boulevard lighting.

NEWS NOTES

INCORPORATIONS.

LOS ANGELES, CAL.—Meadows Water Company, $50,000, subscribed $30, by H. M. Hall, W. Mackendrick and W. A. Whelan.

WALLA WALLA, WASH.—Capitalized for $120,000 the Walla Walla River Power Company has filed articles of incorporation at Salem. The company plans to build a power plant several miles below the forks of the Walla Walla, taking water from the river through a flume. Power for pumping and other purposes will be sold.

SOUTH BEND, WASH.—The Willapa Power Company, recently granted a water and light franchise for South Bend, is incorporated with a capitalization of $1,000,000, divided into 10,000 shares of $100 par value. Its purpose is to supply electric power, water power, gas, etc. The site of its construction is the South Fork of the Willapa River, and the principal place of business South Bend.

TUCSON, ARIZ.—Articles of incorporation of the Three Rivers Land & Water Company have been filed with the Arizona Corporation Commission. The capital stock is $500,000, and the incorporators are T. H. Schuster, B. W. Smith and James R. Dunseath, all of Tucson. The nature of the proposed business is general real estate and water business, to include construction of necessary dams, canals, flumes, etc., also to construct and acquire telephone lines and stations and all necessary appurtenances thereto.

PARKER, ARIZ.—Articles of incorporation of the Parker & Colorado River Electric Railway Company have been filed with the Arizona Corporation Commission. The capital stock is $250,000, and the incorporators are: Thomas Taylor and David Connor of Jerome; J. E. Beck and W. H. Tharpe of Parker; I. W. Wallace, Bisbee and Wm. Drury, Lowell. The company proposes to construct and maintain an electric railway, telephone and telegraph business in and around Parker, and through the Colorado River Indian reservation, a distance of approximately 35 miles.

FINANCIAL.

SAN FRANCISCO, CAL.—At a meeting of the stockholders of the Ocean Shore Railroad Company last week a unanimous vote was taken to levy an assessment of $5 a share. This is expected to realize about $190,000, and it is said this sum will meet the company's requirements until February, 1915.

GLENDORA, CAL.—The stockholders of the Glendora Light & Power Company at a meeting held today, passed a resolution petitioning the superior court for the dissolution of the company and empowering the board of directors to distribute, pro rata, the proceeds of the sale of the electric light and power plant. The distribution is to be made as soon as it can be legally done. The Glendora Light & Power Plant was taken over the first of April after an agreement of purchase by the Pacific Light & Power Corporation. After the order of dissolution by the court, the plant will become an integral part of the general system of the Pacific Light & Power Corporation.

SAN FRANCISCO, CAL.—A group of the largest stockholders recently purchased $1,200,000 Great Western Power bonds. The price at which the sale was made is not given but it is said that the bonds were placed considerably above the present market. The last sales on the local exchange were at 81. The authority given by the state railroad commission was to sell the bonds at a minimum price of 90, from which it is obvious that they could not have been sold at a lower figure. The proceeds from the sale will be used to make a number of small extensions during the next few months and to provide for the installation of another unit at the Great Bend power plant. Mortimer Fleishhacker, president of the company, also made arrangements while East to take care of the $1,250,000 Western Power notes maturing in July, 1915.

SALT LAKE CITY, UTAH.—A dispatch from New York says that the six per cent short time notes of the Utah Securities Corporation are now being retired. Although no amount was stated in the dispatch, it is understood that it is around $85, the price to which the securities have declined in the past few days. This price, however, shows a good profit for the holders of the notes, who were able to purchase them last fall as low as $72. The notes will be taken up by the Securities Company to the extent of $6,000,000, the amount available for this purpose from the proceeds of the sale of $10,000,000 of the bonds of the Utah Power & Light Company. The notes, of which there are now approximately $22,000,000 worth outstanding of an authorized issue of $30,000,000, were issued in connection with the purchase of properties now operated by the Utah Power & Light Company and the Western Colorado Power Company and for the construction of additional power and transmission facilities — these latter expenditures aggregating $6,000,000. The withdrawal of approximately one-third of the notes from the market by retirement will probably do much toward stiffening the quotations on the balance left outstanding, and as it will not be long until further tenders are asked for, the notes may be expected to remain firm around present prices.

ILLUMINATION.

AUBURN, WASH.—The Auburn Gas Company has applied for a franchise to lay gas pipes on the streets and alleys of this city for 25 years.

ST. HELENA, CAL.—The contract for installing 37 electroliers on Main street has been awarded to the Napa Valley Electric Company for $3108.

CHEHALIS, WASH.—The Chehalis-Centralia Gas Company has reduced its gas rates, in effect as of April 1, 1914. The new maximum rate is $1.75 per 1000 and graduates down to $1.30 per 1000.

NOGALES, ARIZ.—The common council has called an election for May 25th, to submit to the qualified voters the question of granting an electric light and power franchise to Spiro S. Prots and Monte M. Mansfield. The franchise is to run 25 years, commencing June 15, 1914.

GLOBE, ARIZ.—Howard L. Sawyer, consulting engineer, employed by the city to make a disinterested estimate of the cost of a municipal light plant in Globe, has placed the estimate at $89,800, power plants and equipment, engines, switchboards, generators, etc., to cost $45,300 and distributing system to cost $15,600.

BAKER, ORE.—The examinations and reports department of H. M. Byllesby & Company has been employed by the Eastern Oregon Light & Power Company to make a complete inventory and valuation of its property in the state of Oregon. The appraisal is regarded as a necessary foundation for the adequate presentation of the company's rate schedules to the Oregon Public Service Commission. The Eastern Oregon Power Company owns all the available water power in the vicinity of Baker (formerly Baker City) and La Grande, and serves a considerable number of communities.

LOS ANGELES, CAL.—The city council has set aside the temporary gas rates recently fixed by the board of public utilities and determined that the natural gas rate for the city proper should be fixed at 40c per 1000 cubic feet from the time the ordinance fixing the rate becomes effective until July 1, the date when new utility rates shall become effective for the ensuing fiscal year. At the same time the council determined that the natural gas rate for the harbor district shall be 70c per 1000 cubic feet. The city attorney was instructed to present the necessary ordinance fixing the new gas rates.

SOUTH PASADENA, CAL.—Steel posts with a copper sheathing, similar to those in the Oak Knoll district, Pasadena, have been chosen for the ornamental street lighting system. Uniform posts for the entire city are to be used. Oak street will probably be the first to install ornamental lights, as the petitions have already been signed. If the city should act as a whole and install an ornamental lighting system the board of trustees would be enabled to purchase the electric energy at a very low wholesale rate, which would be about 3½ cents per kw.-hr. instead of the present rate. The streets committee is to investigate putting the system in over the entire city at the same time. The metal posts have a base and capital of cast iron, while the column is a steel shaft, all locked together by the rods extending the entire length of the post. The steel shaft is covered with sixteen ounce copper, and the cast iron parts are painted to match the shaft.

TRANSMISSION.

CASHMERE, WASH.—The Cashmere Water Power Company is seeking a franchise for light and power privileges. L. H. Titchenal is president and treasurer of the new company.

PORT ANGELES, WASH.—A resolution was passed by the city council recently granting the Olympic Power Company the right to construct and maintain a transmission line in this city.

NAPA, CAL.—Bids will be received by the board of supervisors up to May 13th for the franchise of the Calistoga Electric Company to erect lines for transmitting electricity in the county of Napa.

ANDREWS, ORE.—The Wild Horse Power & Milling Company has completed preliminary surveys and is having plans prepared for a hydroelectric power plant to be constructed near Andrews at the mouth of the canyon of Wild Horse Creek. The nower will be used for miscellaneous purposes.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has arranged the expenditure of $1,000,000 for extensions and improvements deemed necessary to take care of the extra service during 1915. New substations have been arranged for, and contracts for the rotary transformers and other machinery have been let to the Westinghouse company. The company also has contracted for a wide extension and enlargement of its gas main system.

SAN BERNARDINO, CAL.—Material is on the ground and work will be begun at once on the construction of the power line from this city to El Centro in the Imperial Valley by the Southern Sierra Power Company. The line will be an extension of the line from Inyo county to this city and when completed will be the longest high power line in the world, covering a distance of 586 miles. It is expected the line will be completed into the Imperial Valley in from two to three months, as work is to be rushed.

ROSEBURG, ORE.—The Oregon & California Power Company has made application to the county court for the use of public roads in Douglas county for the construction, maintenance and operation of poles and wires for the transmission of electric current. The company owns six large generating plants in Jackson, Josephine and Klamath counties, Ore., and in Siskiyou and Shasta counties, Cal., and it is now invading northern territory. Recently it bought the plant at Glendale, and the company wishes to enlarge in its Douglas county field, by selling electricity to the farmers. This power will he used for all purposes, especially pumping water for irrigation, according to their plans. It will not operate in Roseburg, or in competition with present plants, according to its statements to the county court. The company now has over 400 miles of line, and supplies 31 towns and villages with electric service.

BRIGHAM CITY, UTAH.—The city council of this city has decided to wage a vigorous campaign against the extravagant use of electric power by the patrons of the municipal plant. The municipal plant has always furnished service on a flat rate basis and the patrons have been so extravagant in the use of their lamps and appliances that the lines have become so heavily loaded that it is difficult to give good service. A circular letter will be issued and sent to all users of current, warning them against the use of more electricity than they pay for. After this warning, a canvass will likely be made to determine just how much power is being used by each consumer. The council also proposes to employ a competent electrical engineer to make a complete inspection of the city's electric light system and make a report of conditions as he finds them. This will be done for the purpose of ascertaining what repairs are necessary and what will be required to bring the plant up to date.

TRANSPORTATION.

LOS ANGELES, CAL.—Plans for the Pacific Electric car line extension into Griffith Park are being considered by the park commission.

RED LODGE, MONT.—In the elections in Red Lodge and Bear Creek the granting of a franchise to the Red Lodge Electric Railway Company carried by a large majority.

FRESNO, CAL.—Bids will be received up to June 1 for the sale of a franchise applied for by the Fresno Interurban Railway Company to construct a railroad on Fresno avenue.

SAN DIEGO, CAL.—The San Diego Electric Railway Company has presented a petition to the city council asking for new franchises on F and Laurel streets and for permission to take over the Point Loma Railroad.

SACRAMENTO, CAL.—The petition of Z. P. Dyer, owner of one share of stock in the Sacramento Valley Electric Railway, for an injunction to stop that corporation from building twelve miles of line from Dixon to Sacramento, was denied by Justice Seawell.

SACRAMENTO, CAL.—One hundred and fifty men are engaged in laying double tracks on the Tenth street line from a point north of Q street to Y street, which work when completed will provide a double track to the baseball grounds at Buffalo Park. It is expected to operate cars over the new tracks within three weeks. The work is being done in accordance with an order of the city commission by the Pacific Gas & Electric Company. Trilby rails are being laid.

SAN FRANCISCO, CAL.—The supervisors have authorized the building of the Masonic avenue extension of the Geary street car line to the baseball park, to cost $29,513. It is proposed to have Mahoney Bros. do the work under the present contract for building the Van Ness avenue and Chestnut street lines at the same unit cost. Assistant City Engineer Hunt said the city would save between $2000 and $3000 and some time by doing the work in this manner. The extension will extend four blocks, from Geary to Turk.

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PORTLAND, EUGENE & EASTERN ELECTRIFICATION.
BY PAUL LEBENBAUM.

PROGRESS IN TRANSMISSION LINE CONSTRUCTION
BY A. S. KALENBORN.

RESISTANCE OF STATOR WINDINGS OF INDUCTION MOTORS.
BY ALFRED STILL.

ELECTRIC SMELTING AND REFINING.

LIGHTING FOR PROFIT.
BY H. E. GRANT.

UTILITIES AS AN INVESTMENT.
BY LOUIS GUENTHER.

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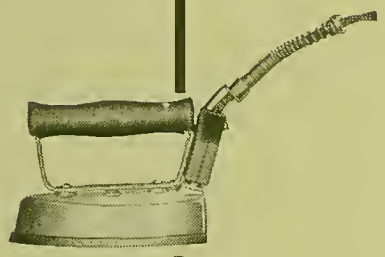
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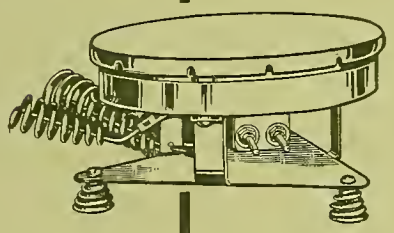
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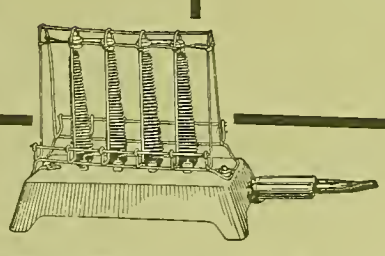
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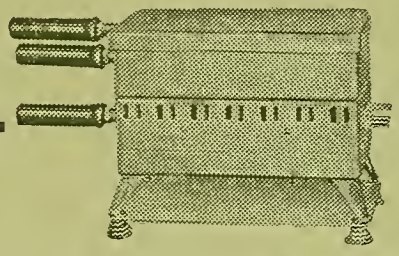
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JOURNAL OF ELECTRICITY
POWER AND GAS
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PORTLAND, EUGENE & EASTERN ELECTRIFICATION

BY PAUL LEBENBAUM.

(This article covers the electrification of first unit of the Southern Pacific lines in Oregon, under the auspices of the Portland, Eugene & Eastern Railway. The distribution system is described in detail as is also the overhead construction, rail bonding, dispatching and telephone system, rolling stock, car equipment and control; also its advantages. Mr. Lebenbaum presented the paper before a joint meeting A. I. E. E. and N. E. L. A., Portland, Oregon, March, 1914.—The Editors.)

This development had its beginnings as far back as 1904, when a report was submitted covering the electrification, by means of a 2200 volt system, of a portion of the line between Portland and Forest Grove, and Portland and Oswego, with a possible extension of the latter line from Oswego to Oregon City.

The report, however, was never acted upon, so that when in 1909 a request was made for a new report, the advance in the field of electric traction since



Interior Oswego Substation.

1904, made it desirable to consider some other than the 2200 volt a.c. system.

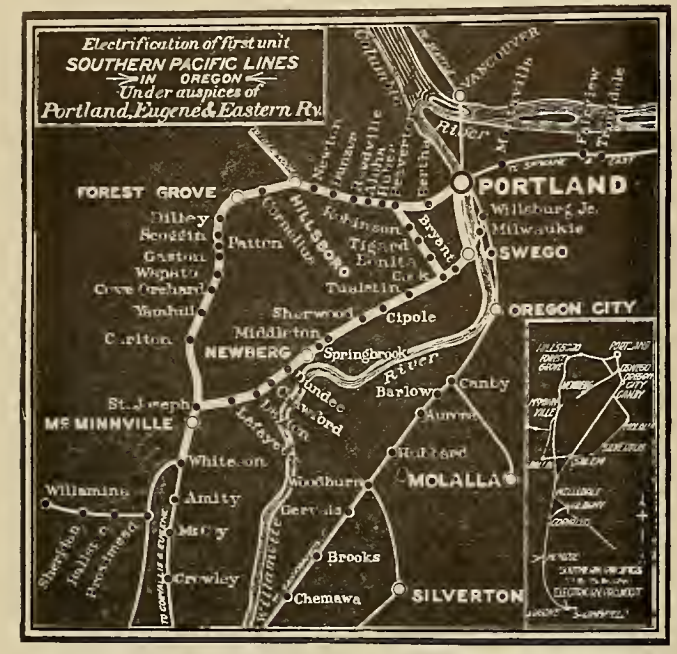
The Southern Pacific Company having decided upon a 1200 volt system for its suburban lines around San Francisco Bay, it was but natural that the same type of system be given more consideration than any other in electrifying the company's lines out of Portland.

At the time specifications were drawn up for the substation machinery and multiple unit car equipment, manufacturers were requested to bid on 1500 volt equipment as well as on 1200 volt. The saving in feeder copper possible with a 1500 volt system as against the 1200 volt, which, for the same loads and the same percentage drop to any point is 56 per cent, caused the higher voltage to be adopted. Though no announcement was made, for reasons of policy, at the time this apparatus was purchased, it was the first manufactured for a trolley voltage of 1500, although due to unavoidable delays in construction it was not the first road to be put into operation at that voltage.

The first section of this system, recently completed and put into operation, is shown on the accompanying map.

The 1909 report covered the electrification between Portland and McMinnville of the then existing steam lines. In 1911 a comprehensive report was made by Robert E. Strahorn, now president of the Portland, Eugene & Eastern, covering a system of electric

lines in the Willamette Valley as shown on the lower corner of the map. This development covered a total of 340 miles of electrified tracks, some entirely new lines, the remainder at present under operation by steam. The company also owned and operated at that time, street car systems in Eugene, Albany and Salem, and a survey and some right of way between Eugene and Monroe, in addition to the logging road between Monroe and Corvallis.



Map of First Unit P. E. & E. System.

These Portland, Eugene & Eastern properties were acquired by the Southern Pacific Company, and the complete electrical development given this name.

The original substation locations determined upon for the first unit between Portland and Whiteson were at Bertha, the summit of the long grade west of Portland, Forest Grove and Dayton. Keeping in mind, however, the extension of the lines south from McMinnville towards Corvallis, and south from Oswego towards Salem, the logical site for a substation in the vicinity of Portland became Oswego, and on account of the necessity for a substation at McCoy, the substation proposed for Dayton was finally located at Dundee, which is some four miles nearer Oswego.

The following description applies only to the two lines running south from Portland to Whiteson, one via Forest Grove, the other via Newberg.

The physical conditions prevailing on the Loop make it possible to have all three substations feed into the larger portion of the electrified mileage—in fact, out of 105 miles of main line, 69 miles (lying east of Forest Grove and Dundee) is fed by the three substations. This is made possible by connecting the north and the south sides of the Loop from Beaverton to Cook over what is known as the Cut-Off, which permits both Dundee and Forest Grove, even if to only a small extent, to help Oswego carry the greater load that naturally exists at the main terminus of any railroad. In order to furnish the train ascending the long grade out of Portland on the Forest Grove line more directly with energy than by feeding all the way from Oswego to Portland via the East side (or Newberg) line and then back over the West side (or Forest Grove) line, a tie line, consisting of both positive and negative feeders, was built from a point on the East side line three miles nearer Oswego, to a point on the West side line, which is close to the summit of the grade, the length of the tie line being 2200 ft.

Energy Supply and Distribution.

Energy at 55,000 volts and 60 cycles is supplied to the system under a contract with the Portland Railway, Light & Power Company, who deliver it at Milwaukee to the railway company's transmission line. This line, 2¼ miles long, is built on the railway company's right of way from Milwaukee to Oswego, using standard 60,000 volt construction, with pole spacing of 150 ft. It crosses the Willamette River on special supports attached to the side of the railway bridge just north of Oswego; at the entrance to Oswego substation, there is a horizontal double break pole top, disconnecting switch, operated from the ground by a lever that is normally locked. It enters the substation through roof bushings, a tap being taken in the line just ahead of the bushings, to the horn gap switch for the lightning arresters, this switch being mounted on an iron framework on the roof of the substation.

In deciding what the voltage of the transmission lines should be, the question of the type of machines to be installed in the stations was a determining factor. On account of the 60 cycle supply synchronous motor generator sets had to be used.

It must be remembered that the conversion apparatus for these substations was purchased in 1911, at which time there was no idea of the possible use of 60 cycle, 1500 volt, rotary converters.

It being perfectly feasible to build the motors for any voltage up to 13,200, two alternatives were presented; one to transmit at 55,000 volts to each substation, and install transformers to step down to 2300 volts for the motors (this giving a machine somewhat lower in first cost than a 13,200 volt motor); the other to combine all transformer capacity in one substation



Crossing of Oregon Electric and Portland, Eugene & Eastern, Showing 60,000 and 13,200 Volt Transmission Lines and 1200 and 1500 Volt d.c. Trolley Line.

(Oswego), where on account of the larger diversity factor existing between the various substations, transformers of an appreciably smaller total rated capacity could be installed, 13,200 volt motors could be used in all substations, and transmission could be at 13,200 volts to the other two substations for application directly to the motors.

Balancing the lower cost of motors and transmission line copper plus the transformers required in three substations if 55,000 volts were used, against the higher cost of motors and copper plus the transformers in only one substation if 13,200 volts were used, it was found that the latter would be most economical.

The 13,200 volt line from Oswego to Forest Grove is 26 miles long, and from Oswego to Dundee is 22 miles long. The line is carried at the top of the poles supporting the catenary trolley construction, is of No. 1/0 copper and the three wires are placed in a horizontal plane on the cross arm. Malleable iron insulator pins, cemented into the insulators and held to the cross arm by a ¾ in. bolt, are used. The lines terminate on pole top disconnecting switches just outside of each substation.

Substation Equipment.

Oswego substation, besides containing the motor generator sets, together with their switchboards and switching devices, that are common to all three substations, has installed in it the transformers that serve the loop lines. There are two, each of 1000 kw. capacity, three-phase, primary voltage 55,000, secondary voltage 13,200, with taps on both primary and secondary. They are connected star on both high and low sides, this being permissible on account of the balanced character of the load.

Transformers are oil insulated and water cooled, one transformer only being required to handle the entire load of the system. On the high side they are protected by 60,000 volt disconnecting switches and three-pole automatic electrically controlled oil switches. These oil switches are of the Baum type, extensively used in California on some of the larger systems and have a horizontal break, two breaks in series per pole. On the low side they are directly connected to the 13,200 volt distributing bus by means of automatic oil switches and knife disconnecting switches. From this distributing bus are taken the lines that feed the different substations. Outgoing 13,200 volt lines are protected at the substation by means of electrolytic lightning arresters. Both 60,000 volt and 13,200 volt electrolytic lightning arresters are of the four-cell type, one cell being placed in the ground connection.

A short description of Forest Grove substation will cover also the means taken in Oswego and Dundee substations to transform from 13,200 volts a.c. to 1500 volts d.c.

The incoming transmission line is equipped with electrolytic lightning arresters, horn gaps and automatic switch. All oil switches are electrically controlled, current being obtained from either a small 4½ amp. storage battery (8 hr. rating) or the exciters of the synchronous motors. These latter are started at half voltage from an auto-transformer, the starting and running switches of each set being electrically and mechanically interlocked so that only one can be thrown at a time.

The motor generator sets, of which there are two at each station, consist of a 560 kw., 13,200 volt, three-phase Y connected, synchronous motor, with a speed of 720 r.p.m., direct connected to a 500 kw., 1500 volt, d.c. compound wound, generator. An 8 kw., 125 volt exciter is mounted on the shaft. The set has two bearings. The a.c. switchboard consists of an incoming line panel, two motor control panels, and a battery and lighting panel. All apparatus thereon is standard The d.c. switchboard has two generator and two feeder panels. The breakers and switches, being 1500 volts, are remote mechanical control, the operating handles passing through to the back of the board. The circuit breakers are mounted at the top and front of the panels, and the main switches at the rear of the board on a separate slate base.

The generator breakers are equipped with reverse current relays and no-voltage release. The trolley is sectionalized in front of each substation, each section being fed by individual feeders from the 1500 volt station bus.

The auxiliary equipment in each substation, besides the battery, consists of a 5 kw., 13,200/120 volt transformer for supplying the light and power circuits, and a small motor driven air compressor for cleaning.

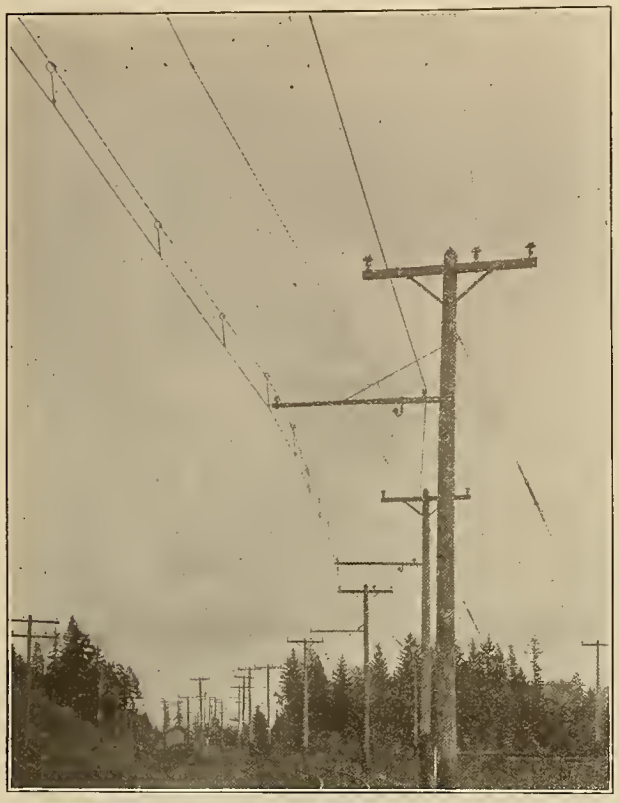


Exterior Dundee Substation.

The substation buildings at Forest Grove and Dundee are 60 ft. long by 40 ft. wide and are of reinforced concrete throughout. The Oswego building is 62 ft. long and 62 ft. wide and is divided longitudinally into a transformer section and a conversion section each 31 ft. wide. The transformer section consists of two floors, the upper containing the 60,000 volt busses, switches, lightning arresters and metering transformers and the lightning arresters for the 13,200 volt outgoing feeders. The ground floor contains the two 1000 kw. lowering transformers, each of which is set in a separate fireproof compartment. A Kinnear rolling door is provided for the front of each compartment; transformers rest on rails and for repairs may be slid on to a four-wheel truck that runs on a depressed track serving both compartments. Space is provided for a third transformer this space being at present occupied by oil storage tanks and an oil filtering and drying outfit. The tanks, drier and transformers are so piped that oil can be removed

from either transformer, filtered or dried, and pumped back without interfering with the operation of the transformers.

All 13,200 volt wiring, disconnecting and oil switches and current and potential transformers are in bus compartments, the phases of each circuit being separated from one another by barriers of transite and



Single Track Curve Construction With 13,200 Volt Transmission Lines.

the various circuits by concrete barriers. This construction gives an efficient but inexpensive bus structure.

Overhead Construction.

The details of the material used in the construction of the overhead, feeder and trolley system were developed by the Southern Pacific Company on its lines on the east side of San Francisco Bay, some slight modifications being made to meet local conditions.

The standard pole spacing on tangents, and curves up to 2 degrees, is 150 ft.; on curves from 2 to 4 deg., 120 ft.; on curves from 4 to 6 deg., 90 ft.; and on all curves over 6 deg., 60 ft. On future construction these spacings, on account of a new method used in pulling off curves, will be so modified as to eliminate the 60 ft. spans. In arriving at the proper tension at which to string the messenger wire, due consideration was given to the ice and sleet loads that might obtain, and under maximum load conditions, the tension in the messenger does not exceed the elastric limit. The wire was strung in the field at a tension of 2200 lb. at 70 deg. F. On the standard 150 ft. span, the distance between trolley and messenger is 24 in. at the bracket, and 6½ in. at the center of the span. Hangers are spaced 15 ft.

The standard bracket arm consists of two 2½ x2x5/16 in. angles, attached to each side of the pole, brought together at the outer end, and supported by a 5/8 in. bracket rod. All line material is galvanized. The feeder is carried on a plate attached to the bracket arm and is 336,534 c.m. aluminum, or the equivalent of No. 4/0 copper. Mechanical sleeves of the McIntyre type are used to splice the feeder. Taps are made by means of a two bolt aluminum clamp, that takes both the feeder and a No. 4/0 copper cable,



Double Track Overhead Construction With 13,200 Volt Transmission Lines.

the latter being then soldered into a standard 7 in., 4 screw, feeder trolley ear.

All poles are cedar with 9 in. tops, and are set 8 ft. from face of pole to center line of track. Where transmission lines are carried on trolley poles, these are 45 ft. long and set seven feet in the ground; otherwise poles are 40 ft. long and set 6 ft. 6 in. in the ground. All poles are given two thorough brush treatments with an approved preservative from a point 18 in. above the ground to within three feet of the butt. The preservative is applied by means of burlap fastened to the ends of long mop handles, and is kept hot by steam coils placed in the bottom of the shallow tank over which the poles are rolled.

The total mileage of electrified tracks is about 105, exclusive of sidings, spurs and yard tracks.

Rail Bonding.

All rails are single bonded with the American Steel & Wire Company's pin expanded bonds, of No. 4/0 capacity. Both the flexible and ribbon type bonds are used, the first on 75 lb. S. P. standard tee-rail, and the latter on 90 lb. A. R. A. rail.

Of the total main line mileage, there are 40 miles of 90 lb. rail and 65 miles of 75 lb. rail. All rails are provided with joint plates designed to give sufficient clearance for the bonds.

Telephone System.

Train dispatching is handled by means of telephones, a selector system being used. The selector is an electro-mechanical device whereby the electrical circuit of any one of a number of bells, connected across the telephone lines, is controlled from the dispatcher's office at Portland, without affecting any of the other bells connected across the same line.

The selector in each station is set to respond to certain electrical impulses, the proper combination of currents being accomplished by an individual calling key, consisting of a simple train of gears, operating a circuit breaker, somewhat similar to the familiar district messenger call box. One such calling device, or key, is provided at the dispatcher's office for every station on the line.

The train dispatcher is assured of the call being received at the station, as he receives what is termed an answer back signal from the station bell itself, this being a very distinctive click that lasts as long as the bell rings.

Selectors in each station are placed directly across the line, the current for operating selectors being obtained from a central battery located at Portland.

In addition to selectors in all stations where agents are situated, mine sets have been installed along the line at all other points where there are spurs or sidings, but no station facilities. These mine sets are connected directly across the telephone line, and enable train crews to call the dispatcher for orders. These mine sets are enclosed in weatherproof iron boxes, and are generally placed in the shelter sheds adjacent to the spur.

In addition to the telephone line used for train dispatching, there is a circuit that connects all the substations, construction and maintenance headquarters, the train dispatcher, shops and the electrical engineer's office in Portland. The selectors on this power circuit, as it is called, are operated by means of an intercommunicating key, whereby any station can call any other station, without having to work through a central office.

The dispatching circuit consists of No. 9 B. & S. hard drawn copper wire, and the "power" circuit of No. 9 B. & S. copper clad wire.

Cars and Equipment.

The rolling stock equipment for the electrified lines consists of seventeen combination passenger and baggage cars, thirteen motor coaches, eleven control, or trailer coaches, and five baggage and express cars. In addition to the above, there are now under order three mail, baggage and express cars. This gives a total of 49 cars, of which thirty-eight are motors.

Car bodies were built at the Chicago plant of the Pullman Company and the trucks at the Baldwin Locomotive Works.

The three types of passenger cars are of the same general design, and are of steel construction throughout, except for the interior finish; the headlining and wainscoting are agasote, and the window sash, mouldings, battens and frieze panels are mahogany.

All cars are 56 ft. 10 in. long over buffers and 9 ft. 2 in. wide over sills. The motor and control coaches seat 60 people, and the combination passenger and baggage cars 52. Motor cars weigh approximately 50 tons, completely equipped and ready for service; control cars weigh 33 tons.

The electrical equipment is of the multiple unit type, consisting of four GE-205-B motors, and the necessary motor and control apparatus. The gear ratio is 54 to 20, giving a speed of approximately 50 m.p.h. on level, tangent track. The equipment is designed to operate at full speed on 600 volts, as well as on 1500 volts, the motors being in series and series multiple on the high voltage and in series multiple and multiple on the lower voltage.

Current is collected with a pantograph, the collector proper being two feet long and five inches in diameter. The collector had cone bearings when received, but owing to bearing wear on long runs the company is developing a roller bearing.

In single car operation the pantograph is raised and lowered by air, but in operating with more than one motor car the pantographs are controlled electropneumatically so that all pantographs can be raised or lowered at the will of the motorman. Each car is equipped with a hand air pump for raising its pantograph before the air is pumped up by the compressor.

While the first cost of the device is much more than the trolley pole and wheel, its cost of maintenance is about one-third per 1000 car miles.

There are no unusual features in the motor circuits. Fifteen contactors are used to make the resistance combinations, which are the same for either fifteen hundred or six hundred volts. The resistance connections for both voltages are made through the commutating switch.

The circuit breaker is especially designed so as to permit of double the current setting on 600 volts as on 1500 volts, this being accomplished by a graduated tripping spring while on 1500 volts, and a magnet coil while on 600 volts. The magnet coil is energized through contacts on the commutating switch which make on 600 and are open on 1500.

There are a number of other devices in the control circuit that may be of interest in that they are features that have been worked out so that the cars will change automatically when passing from 600 to 1500 volts after the commutating switch on the leading car has been thrown to the desired position by the motorman from his cab, which he does by means of a valve switch.

By means of a specially designed potential relay it is impossible to throw the commutating switch while the pantograph is on a live trolley wire. The relay has three sets of interlocks. Two sets are in circuit with the wires that operate the commutating switch and one set in circuit with the No. 2, or holding wire, in the control circuit. The relay is energized whenever the pantograph is on the trolley and opens the interlocks on the control wires to the commutating switch, closing the interlocks on the No. 2 wire. As soon as a dead section is reached by the pantograph the relay drops out, the interlocks on the commutating switch control wires make contact, and the commutating switches can then be thrown automatically as each car passes the change over or dead section from 600 to 1500 or vice versa. This is brought about

by the motorman throwing the valve switch above mentioned to the desired position on the head car, which throws the commutating switch on the first car by air direct; commutating switches on the following cars then throw electro pneumatically. It is necessary to hold the valve switch handle in position until all cars are across. It is necessary when throwing the switch on the leading car or single car to



Combination Passenger and Baggage Car.

have the controller in the off position, as the practice is to change over head car just before getting on the dead section. It is not practicable to change over to 1500 volt position on 600 volt trolley as the dynamotors that furnish light, control current and air will not generate enough voltage to pick up contactors in this combination.

The dynamotor has a double wound armature, the 1500 volt winding motoring the compressor, and generating on the 600 volt end current for lighting and control. On 600 volt the 600 volt end motors the compressor and the 1500 volt end remains neutral. This is accomplished by special connections and changes made when the commutating switch is thrown. The dynamotor has a permanent resistance of 18 ohms between it and the trolley connection in the 1500 volt position.

The air compressor is operated by means of a clutch which is engaged and disengaged by air pressure. The air pressure is governed by an electric magnet valve which is operated from a type "J" Westinghouse air governor; the speed of the dynamotor is constant, whether pumping or not.

When passing on to a dead section, in order to prevent flashing and burning up of section insulators, a time limit potential relay has been provided and by means of brushes placed at either end of dead sections and auxiliary contacts on the pantograph frame which are just ahead of the roller the relay is picked up, causing all line contactors to drop out. The relay is fitted with a dash pot that prevents its dropping back quickly. A selector relay is provided, which prevents 1500 volt trolley current from passing into the 600 volt circuits. A by-pass relay is also provided for stepping up by hand control and getting off a resistance point when the current through the current limit relay is excessive and will not allow the latter to drop and automatically step out the resistance points.

The air brakes on the cars are Westinghouse universal type; as the name implies, any type of air brake can be used in connection with it without changing air piping, as all piping runs to a pipe bracket, to which bracket the parts of the universal valve are bolted. The following are a few of the salient features of the equipment.

It is automatic in action;

It gives maximum protection against complete loss of the brakes due to failure of any part of the system;

It has a quick recharge feature;

Full emergency pressure is applied automatically when a predetermined brake pipe reduction is made after equalization.

Quick action is obtained automatically when brake pipe pressure is depleted below a predetermined danger point due to leakage or any other cause.

There is also a rather important feature in connection with the brakes; a car cannot be moved until the air pressure is pumped up so as to cut in an automatic control switch and complete the control circuit of the contactors.

Capitalization of water rights by water companies is legal and may be included in estimating the total investment in connection with rate-making. This is the substance of a decision of the Supreme Court of the United States which reversed Judge Morrow in the San Joaquin & Kings River C. & I. Co. vs. Stanislaus County case. An article on this important case is in course of preparation by A. E. Chandler and will be published in an early issue of this Journal, as well as on a case recently handed down by the California Supreme Court entitled Del Mar Water, Light & Power Company vs. Eshelmann, et al This latter case deals with water right contracts and the right of water company to restrict its territory and its consumers. The supreme court holds that it may do so, thus reversing the California Railroad Commission, which had held to the contrary.

In the great Palace of Machinery at the P. P. I. E., will be assembled exhibits of machinery used in the generation, transmission and utilization of power. The several groups will comprise examples of steam generators and motors; internal combustion engines; hydraulic engines; miscellaneous motors; general machinery and accessories; and tools for shaping wood and metals. To these will be added ten special electrical groups covering the generation, distribution and control of electrical energy in its application to mechanical and motor power, lighting, and heating. Special effort will be made to classify and display the exhibits of machinery so that they will have educational value to the public as well as to afford comparative interest and profit to inventors, machinists and manufacturers. The increasing use of electrical apparatus in the industries, vocations and affairs of life caused the management of the exposition to abandon the use of a separate building for electricity and distribute the machinery and apparatus throughout the palaces according to its use in the various industries.

PROGRESS IN TRANSMISSION LINE CONSTRUCTION.

BY A. S. KALENBORN.

(In this article the author describes the construction and characteristics of three parallel transmission lines which, constructed at different periods, indicate in an interesting manner the development of transmission line practice.—The Editors.)

A very interesting exposition of the progress that has been made in the construction of high tension transmission lines is to be seen on the peninsula just south of San Francisco.

Three parallel, high tension lines skirt the bay shore at a short distance eastward from the Southern Pacific Railroad line down through the peninsula towns of San Bruno, Millbrae and Burlingame,

Two of these lines are 60,000 volt construction on wooden poles belonging to the Pacific Gas & Electric Company and the third is a 100,000 volt steel tower line of the Sierra and San Francisco Power Company.



"These Three Dissimilar Lines Marking the March of Development."

The accompanying half-tone shows the three lines as they appear from the car windows.

The closely spaced poles are those of the old Standard Electric Company and are square sawn redwood 35 ft. poles spaced 40 per mile.

This line was built around the bay in January of 1901, so the line is now thirteen years old. (E. W. Vol. 39, p. 25). This was one of the pioneer lines in long distance transmission and was the end of a 142 mile line. A composite insulator was used, a porcelain top cemented onto a glass center, which type was soon replaced in the bay region by the larger, all porcelain four part insulator.

Push posts were used at angles instead of guys, on account of there being "no guy line insulator developed to stand 60,000 volts."

The triangle was 36 and 42 in. and frequent transpositions were made in the line wires.

For double construction at the pole top two large wooden brackets were bolted to the poles so as to separate the insulators far enough for requisite clearance.

The eucalyptus pins were inserted in holes, bored into the pole top or into the brackets.

This was one of the first lines on which aluminum was used as a conductor. A 37 strand 471,034 c.m. cable being strung which is still in place.

The poles in the marshes are still in good condition but in the San Joaquin Valley a considerable number have been "stubbed" on account of the poles rotting at the ground line.

The second pole line was built in December, 1905, when the Martin Station of the Pacific Gas & Electric Company was being put into service.

These poles are 50 ft. round cedar spaced 20 per mile, the triangle is a 72 in. one, the insulators four part 14 in. porcelain, and the wire aluminum strand of 350,000 c.m.

Near San Bruno an odd looking pole extension can be seen on some of the old "Standard" poles which increases the height sufficiently to offset the increased sag due to the removal of every intermediate pole.

This extension or pole top can be seen also on the "Bay Lines" of the Pacific Gas & Electric Company near Suisun. The reason for this peculiar construction is not at once apparent. When the "Bay Lines" were being reinstated with four part 14 in. insulators in 1905 there were but two large insulator factories in the United States and the job of turning out seventeen thousand insulators along with their booked orders represented about two years' work for them. We therefore halved the required number of new insulators by lengthening alternate poles and taking out the others as fast as the new insulators were in place.

The result was a saving of one-half the time for the completion of the job, half the cost of insulators, and the salvage of nearly 2000 poles. The cost of the pipe extension was about offset by the value of the reclaimed poles.

To return to the three lines:

The steel tower line shown was built in 1909.

The towers of Aermotor manufacture, two circuit, are 50 ft. high to the lowest arm and 67 ft. to the top. The spacing is 850 ft. or 6.2 per mile.

The conductor is No. 00 six strand, hemp center copper cable.

The insulators are Locke 14 in., five in a string and the circuits are transposed every three miles.

The minimum clearance at span centers is about the same for the three lines as can be seen from the cut.

On all heavy angles the line wires are dead ended on strings of insulators.

All three lines give entire satisfaction, the old pioneer pathfinder, the standard or usual type of wood pole line as now being built and the modern durable steel tower line.

Side by side through pleasant weather and through stormy seasons these three dissimilar lines marking the march of development, transmit the hydroelectric power from the mountains to the western metropolis of the Golden Gate.

The electric furnace for smelting iron was not developed as a competitor of the blast furnace, but for the purpose of finding a furnace and process that would enable the production of iron in localities where blast-furnace practice was not feasible, or where the increasing cost of suitable fuel was becoming prohibitive to existing smelting practices.

ELECTRICAL TESTING

RESISTANCE OF STATOR WINDINGS OF INDUCTION MOTORS.

BY ALFRED STILL.

It is well known that the performance of a poly-phase induction motor may be predetermined with a reasonable degree of accuracy by constructing the Heyland circle diagram from easily obtained test data. The measurements required are:

(1) The current and true power per phase of stator winding when the machine is running light at normal voltage and frequency.

(2) The current, volts, and true power per phase with shaft clamped to prevent rotation, and rotor short circuited.

(3) The resistance, per phase, of the stator winding.

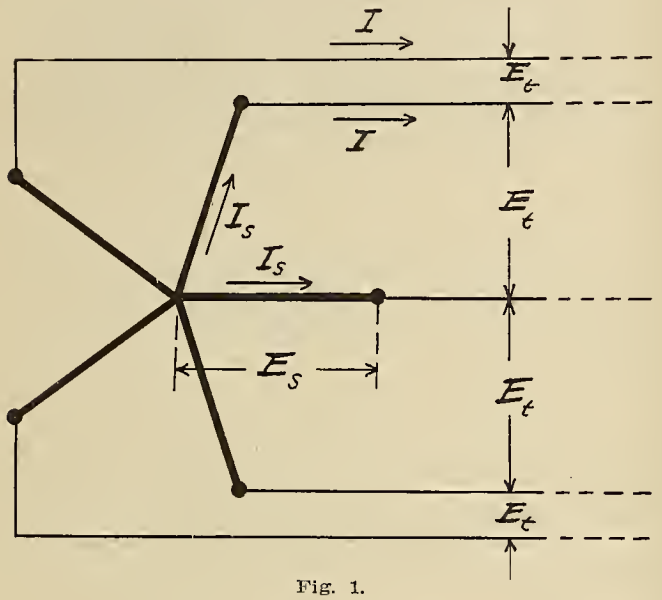


Fig. 1.

In connection with this last measurement, the statement in books treating of poly-phase machines is usually to the effect that the most convenient method of determining the resistance is to pass a known continuous current through the windings, and observe the drop of potential. This statement seems simple and clear until such time as the reader attempts to carry out instructions. He then finds difficulties in his path, especially if the stator is mesh connected. In but one case has the present writer seen a clear statement as to the method of procedure in making this test on a three-phase motor, when the method of connection (whether star or delta) is unknown. This occurs on page 285 of Mr. C. F. Smith's book on alternating current testing. (Practical Alternating Currents and Alternating Current Testing. The Scientific Publishing Company, Manchester, England.)

The following notes have reference to the general case of a poly-phase induction motor wound for any number of phases.

If the stator windings are star connected, as in Fig. 1, the resistance per phase, whatever the number of phases, is $R_s = \frac{1}{2} R_t$ where R_t is the resistance as measured between any two terminals. The potential drop per phase is $\frac{IR_t}{2}$ and the total copper loss in stator winding is $\frac{1}{2} nI^2R_t$ where I stands for the line current (in this case the same as the current I_s in the windings), and n is the number of phases.

In the case of a mesh connected winding, the solution is not so simple. It is desired to find an "equivalent" resistance R_s which, when multiplied by the square of the line current, will give the watts lost per phase. In Fig. 2, the heavy lines represent the windings of a mesh connected stator. The vector construction shows that the current in the windings is

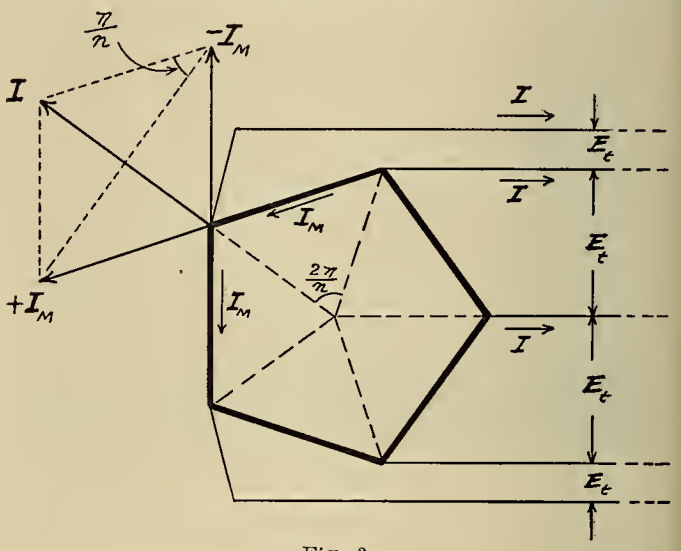


Fig. 2.

$$I_m = \frac{I}{2 \sin \frac{\pi}{n}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The copper loss per phase of the stator winding is therefore $\frac{I^2}{4 \sin^2 \frac{\pi}{n}} \times R_m$ where R_m is the resistance per phase of the mesh connected winding. Let R_t be the resistance as measured between adjacent terminals; then, since there is one path of resistance R_m in parallel with another path of resistance $(n-1) R_m$ it follows that

$$R_m = \frac{n}{(n-1)} R_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

The "equivalent" star resistance, R_s, can be obtained from the equation

$$R_s I^2 = R_m I_m^2$$

$$\text{or } R_s I^2 = \frac{I^2}{4 \sin^2 \frac{\pi}{n}} \times \frac{n}{(n-1)} R_t$$

$$\text{whence } R_s = \left(\frac{n}{4(n-1)\sin^2\frac{\pi}{n}}\right) R_t \quad \ldots\ldots\ldots (3)$$

$$= k R_t$$

Values of k for different numbers of phases are given in the following table:

No. of Phases.	Factor k.
n = 3	1/2
n = 4	2/3
n = 6	6/5
n = 12	4.07

The total copper loss in the stator of a mesh connected winding is $k n I^2 R_t$ while, in the case of a star connected winding, it is $\frac{1}{2} n I^2 R_t$ as previously mentioned. Thus, when k has the value ½, the resistance as measured between terminals will serve to determine the watts lost in the stator windings whether these are star or mesh connected. This value of the factor k corresponds to the three-phase windings, and leads to the simple rule that the equivalent star resistance, R_s, per phase, is one-half of the resistance R_t as measured between terminals, whether the stator is provided with a star or a delta winding. For any larger number of phases, it is necessary to know how the stator is wound. If any difficulty is experienced in tracing through the windings, a simple test will suffice to show whether the stator is star or mesh connected. The resistance between terminals 1 and 2, and also between terminals 1 and 3 should be measured. If the results differ, this indicates a mesh connection, and the formula (3) or the values of k in the table must be used in calculating the equivalent star resistance per phase.

ELECTRIC SMELTING AND REFINING.

Broadly speaking, it may be stated that the feasibility of smelting iron ores in an electric furnace depends upon the relative cost of either charcoal or coke and of electric power. As regards the latter, it must be cheap.

In those electric-furnace iron plants that are operating at the present time only hydroelectric power is used. The cost of producing power for electric-furnace work must, of course, vary with local conditions, and hence depends upon the initial cost per kilowatt of installation. In general, there are few localities where the electric smelting of iron ores would be feasible with the electrical energy costing more than $20 to $30 per kilowatt year.

The cost of making steel in the electric furnace also varies with local conditions. The cost of power does not enter so largely into the final cost as it does in some other electrometallurgical processes, especially the refining of molten steel. Plants are operating successfully under a power cost of 1 cent per kw.-hr. in localities where material can be obtained at the price common to other processes. Plants such as the one at Ugine, France, have been established in remote localities, where the cost of power is very low, 0.2 cent per kw.-hr., but the cost of material is high.

For many years all high-grade steels were manufactured by the crucible process, but since the advent of the electric furnace there has been a gradual adoption of that furnace for refining steel. For the complete refining of the highest grades of steel the use of the electric furnace is now thoroughly established in Europe. Any product that can be made by the crucible process can be made by the electric furnace, and in most cases with cheaper raw materials and at a lower cost. In the electric furnace complex alloy steels can be made with precision. The high temperatures attainable facilitate the reactions, and alloys need not be used so largely for the purpose of removing gas. Very low carbon steels can be kept fluid at the high temperatures. Steels free from impurities and of great value for electrical apparatus can be made. With the electric furnace large castings can be made from one furnace, whereas in the crucible process steel from several crucibles must be used. For small castings, which require a very high-grade metal, free from slags and oxides, electrically refined steel is especially adapted. The electric furnace gives a metal of low or high carbon content as desired, hot enough to pour into thin molds, and still free from slags and gases.

There is now a tendency among consumers of rail and structural steel to require a higher-grade steel at an increased price, rather than steel of acid Bessemer or even of basic open-hearth grade at a lower price. With the high cost of power that now prevails throughout the steel centers of the United States, the electric furnace can not compete profitably with either the acid Bessemer or the basic open-hearth process in manufacturing steel of like grade from pig iron. It is in combination with either of these processes that the electric furnace seems destined to be prominent in steel manufacture. The cost of super-refining in the electric furnace the molten steel from either of these processes, exclusive of the cost of molten steel, varies from $1.50 to $2.25 per ton, depending on the cost of power and the impurities to be removed.

The above information is abstracted from Bulletin 67, "Electric Furnaces for Making Iron and Steel," just issued by the Bureau of Mines. The investigations into electric furnaces for making iron and therein reported, were made by Dorsey A. Lyon, and into electric furnaces for making steel by Robert M. Keeney. The bulletin gives a historical review of the development of electric furnaces for making iron and steel, and discusses the problems which remain to be solved in the use of electric furnaces for the smelting of iron ores and the production of pig iron at a profit and on a commercial scale.

The second part of the report presents a brief historical review of the development of the electric furnace in the manufacture of steel up to the present time. Mr. Keeney describes in detail the types of electric furnaces in commercial operation for the manufacture of steel, and, in general, types which have not yet attained wide use. He gives a description of the practice of the European and American electric-furnace steel plants and compares in a general way the different types of furnaces and the more established methods of steel manufacture with the electric furnace process.

LIGHTING METHODS

LIGHTING FOR PROFIT.

BY H. E. GRANT.

(In this paper, which was presented before a recent meeting of the Alameda County Electrical Development League at Oakland, Cal., the author outlines some of those factors to be considered in lighting for profit and emphasizes the value of active membership in the Illuminating Engineering Society to that end.—The Editors.)

Success in business hinges upon securing profitable customers.

In business no man laboreth for himself alone. Even the so-called "independent" in business for himself, is working for others.

If he is successful; secures profitable customers; profitable, that is, with reference to his cost of doing business; then his accounts too may be paid.

Every man who secures customers is himself, in turn, a customer.

He buys labor. And with his wages, the man who sells his labor pays his own bills, to grocer, butcher, baker and so forth.

He buys material. And the jobber is paid and in turn pays the manufacturer. So the results of his effort may be traced in ever widening circles.

The effort of the individual in business is communal.

For this reason the community has a right to insist that business methods shall be adopted by those who engage in trade.

Yet it is true—criminally so—that the average man is sinfully lax in keeping accounts. Bookkeeping is too often considered an unnecessary burden, and has but a nodding acquaintanceship with this average man.

It is small wonder that so many tradesmen go under. The main difficulty is, however, that "no man striveth to himself alone." The loss must be paid by someone, and generally it falls upon your stable, well-founded tradesman, and in turn upon his customers, and so on.

State laws should be more strict regarding the conduct of business, for the elimination of failures would tend largely to reduce the high cost of living.

Systematic bookkeeping is essential to success in business.

Systematic bookkeeping does not show merely the liabilities and assets, but also the cost of doing business.

Few know what this item really is, and one has only to glance at the enormous difference in the figures of competitive bids to know that such systematic book-keeping is lacking.

So far then, we have two suggestions. First, the securing, which might also include the creating or development of business, and second, proper cost accounting and bookkeeping. On both these matters your society might do well to appoint committees, so that the interests of individual members and all, would be furthered.

A word regarding the securing of business. There are two wrong methods followed. By monopoly uncontrolled, and in the hands of the unscrupulous, and through unfair competition. The first mentioned is not pertinent to this discussion, whereas the last certainly is.

You and I and all of us are interested in fair competition, and are only too glad on any fine day to down tools in order to go to the ball game.

Each side is well matched, and we watch the game with interest. But one side only can win, and competition is keen. Then, looking for an opening, one manager takes an unfair advantage. We detect it, and immediately a howl of protest and condemnation arises. The man and his team are despised.

Why can not this same spirit which insists on equal opportunity in competition for all be carried into our business world?

It is commonplace that this is not done. Some newspapers will "give" away electric appliances as premiums with subscriptions—these appliances are really sold at cost—or the central station, not being dependent on this business, and desirous of securing customers, will wire your house or fill your lamp and appliance requirements at cost, sometimes free of charge; and again within your own camp, wiring contractors, in order to get the business on their own end will supply the lighting fixtures at cost.

None of this is legitimate business. Carried to an absurd extreme, everbody would get everything at cost, and there would be no business, for all would do nothing but "give."

Before we go into this discussion further, let us state the position:

We have electrical manufacturers and jobbers, which two classes can be eliminated as not pertinent to our subject except in that they produce efficiently and distribute in a like manner.

Then we have the dealer who is often a wiring contractor, and the fixture dealer.

Sometimes, as is the case in outlying districts, all three functions are carried out by one individual or firm, this being an economic necessity and under such conditions, representing the essence of good service.

No one objects to any man engaging in any business he pleases. It is imperative though that he conduct his business on business lines, and not transact one class of business at a loss in order to boost his other classes of business, and so beat his competitors.

To any extent to which he does this he indulges in unfair competition—takes an unfair advantage, is a combination in restraint of trade, and should be dealt with as such.

What is needed, is a code of business ethics not only adopted, but lived.

For example, where there is a difference in overhead expense between two classes of business, this should be taken into consideration. The wiring contractor should allow, if he must sell fixtures, a suffi-

cient margin of profit on that item, otherwise he forces the fixture dealer to become a wiring contractor and perhaps in this way, forces himself out.

When we consider the little fellow, the man without overhead of any kind—the screwdriver electrician—we are on treacherous ground.

No one is desirous of eliminating him, but here again the plea must be made for fair competition. All must live.

The difficulty is in his case, that he usually figures incorrectly, like the old apple woman, who, buying twenty-four apples at two for one cent, and the same number at three for one cent, wondered why she lost money at selling them at five for two cents. If he would but conduct his business on a proper basis, with proper reference to others, he would be as welcome to try for business as any man.

Every one must at some time make a start, and usually as one of the little fellows.

There is room for the little fellow in another sense too.

The coming of the carbon filament lamp placed then in the category of things past, the incandescent metal filament lamp. The many inventors and manufacturers of these could see no possible way of competing in the open market with this new carbonized thread lamp which could be produced so cheaply.

It was left to a later age to demonstrate that the American people want quality, not cheapness, as is evidenced by the popularity of the present day Mazda lamp, which has forced its cheap competitor off the market.

Quality is found to be the handmaid of economy. The most expensive things found to be the least expensive.

It is the province of your well established fixture and electrical dealers, to demonstrate this fact, and their efforts, in self-preservation, are towards this end. It is therefore disappointing when the little fellow, not appreciating this need for quality sales to quality purchasers for quality installations, comes along with something just as good at a considerable saving, and so makes an unsatisfactory installation which, in turn, reacts upon the trade.

The point to which your attention is particularly directed is that the little fellow should keep to his small jobs until such time as he can handle the bigger jobs with that understanding which is essential to the exacting of a fair profit.

Figuring for profit is a subject worthy your fullest discussion.

There is a reciprocal tendency on the part of the bigger fellows to crowd out the little ones.

Sometimes the big man's eyes, like those of the horse, magnify the little fellow out of all proportion to his actual competitive importance. For the present, especially if they will be so satisfied, they should at least be allowed the crumbs which fall from the rich man's table. If in some distant future one or more may become prosperous and actual competitors, surely they at this time but contribute to the real prosperity of bigger business.

Let the little fellows pick up the smaller jobs and cheaper. As they do this they achieve their measure of success, keep the floors of business clean, and leave open for larger endeavor—the quality contracts—the energies of bigger business.

Remember, that in bending to compete with weaker rivals, prices are sometimes lowered all round, and occasionally beyond the possibility of being again raised to normal. This creates a condition which adds risk and causes all to work much harder for less gain.

We thus include another factor in our discussion, which is the placing of boundaries to endeavor.

Practically everything which might be offered as solving such difficulties and of assuring the greatest good to the greatest number revolves around the pivotal point of education further enlightened by mutual understanding and agreement.

Your league is to be complimented on the excellent direction of your effort toward that end.

As fixture dealers, wiring contractors, and so forth, you are as individuals and collectively, specialists. Probably you may think that at league meetings insufficient attention is given to the problems of your own craft.

Here perhaps is the solution.

Specialization calls for co-operation, and co-operative effort completes the cycle by pointing to the necessity for co-operation.

Your Electrical Contractors' Association, Fixture Dealers' Association, Section of the American Institute of Electrical Engineers, or National Electrical Light Association, are all essential.

Probably these different associations may have varying periods which require a frequency changer, in order to bring all into harmony.

Such is the value of the joint meeting under a management of diversified though associated interests, and so may your league be both arbiter and harmonizer.

As individuals you cannot belong to too many associations, provided that they return to you either directly or indirectly the equivalent of your dues—with interest being always preferred.

But of all resources, at the present time engaging attention, perhaps the most important is the conservation of cash. Careful expenditure and wise investment obtain everywhere. Wise investment is now more necessary than in the past, and is made wherever profit will result. Those expenses which are useless have already reached the vanishing point.

It is but a short time since electrical men everywhere were only too eager as suggested, to join every engineering or other association launched in connection with the industry. We were, what Elbert Hubbard would call, "A Brotherhood of Joiners." Now we carefully analyze the derivable benefits before the dotted line of the membership application is ornamented with our autograph. A high standard of worth is the measure of desirability.

Membership in the Illuminating Engineering Society is worthy your consideration, but this leads us naturally to the question—"What is the business impulse back of the Illuminating Engineering Society which makes membership desirable?"

It is because the whole trend of the work of this Society has been toward the more general use of light-

ing and the improvement of lighting methods. This has meant wonderfully increased business in the past and may mean a much greater increase in the future.

The aim of the Illuminating Engineering Society has been to educate the general public as to what constitutes the best in lighting methods as well as to evolve the science and improve the art. In this way, not only are the comparatively small number of lighting installations which come under the supervision of the professional engineer much improved, but there is also a general improvement in the standard of the multitudinous smaller installations. This means increased business.

Extensive as the work has been in the past, it needs but a walk along a business thoroughfare or a round of residence calls to show that the principles and advantages of the employment of proper lighting methods has not yet penetrated deeply into the minds of the public.

Ability to direct the improvement of these poor lighting conditions constitutes opportunity.

Other things being equal then they have most opportunity who possess the most useful knowledge along the line of their endeavor, for opportunity will crowd you if you are prepared.

Competition is now so keen in securing lighting business both from the viewpoint of the central station, electrical contractor, fixture dealer, jobber and glassware manufacturers' salesmen, that their selling has become a science.

A prospective customer is a continual expense until his business is secured and along these lines you will find that the business gravitates toward the man with the most knowledge—the one who can give most, even if it is only information.

If time permitted, other arguments might be advanced as to why jobbers, central station, fixture, and lamp salesmen, engineers and manufacturers, should join the Illuminating Engineering Society.

Speaking generally, lighting in the past has been poorly done, and again, that which from the viewpoint of those days was par excellence, is, with our wider knowledge, and invention with its improved equipment, now obsolete. In both cases the lighting systems shoull be replaced, and would be in the majority of cases if someone would but show exactly how it should be done, and give the proof of its greater effectiveness and economy. New lighting installations will be planned by and awarded to the man who knows how, especially in view of the introduction of lamps having a still higher efficiency than the present day Mazda lamps.

Legislation in lighting will be needed and it is essential that it be properly directed and not haphazard as has been the case with headlight and other laws framed by legislators without the aid of expert knowledge.

You should be in a position to supply that knowledge backed up by the weight and authority of the collective effort of your league.

Knowledge of lighting methods for business purposes and to protect yourselves from unfair legislation, is an immediate future need.

A California section of the Illuminating Engineering Society should be formed.

Furthermore, the Illuminating Engineering Society enables you to bring the architect into your counsels, for he too is vitally interested in this important subject of lighting.

You need the architect with you in the interests of improved, and hence more profitable business.

Specifically an architect is one whose profession it is to devise the plans and ornamentation of buildings and to direct their construction. Ruskin's conception of a great architect is—that he "must be a great sculptor or painter." The intricate and diverse engineering problems which enter into the construction of the modern building but interest him in a general way. They are the problems to be solved by specialists—heating, ventilating, structural, electrical, or whatever the case may be.

But it is so easy to mark locations of lighting outlets on plans, and the actual problems are so obscured or unknown, that the placing of the illuminating engineering of buildings into the care of an expert, that the best lighting methods be used, has been the last of the real engineering problems to be reluctantly surrendered by the architect.

But the necessity for the proper planning of lighting installations is everywhere in evidence.

The architect although having surrendered this work must still have a good general knowledge of this science of illuminating engineering.

The architect is the creator who rules over the destiny of the building. Its ultimate evolution into one complete and harmonious whole is within his control.

It is therefore essential that he know positively, just how the work of the illuminating engineer will fit into his decorations, and the fixture manufacturer's design harmonize also—the proper light and shade effect being secured in all parts of the interior. He is the final court of appeal, and when the seal of his approval has been placed upon the work of the several specialists, it must be because the work of all harmonize, that it is in a word, satisfactory.

Information invaluable to the architect would therefore be conveyed through the medium of the Illuminating Engineering Society meetings and discussions.

We need the co-operation of the architect. In the electrical industry we need the architect moving among us as one with us, and if the Illuminating Engineering Society accomplishes this much to be desired end alone, and it certainly opens the way, then it is worthy your support.

We have caroomed pretty well all over and around this subject of lighting for profit, but it is to be hoped that each, from somewhere will extract something of individual benefit.

Lighting for profit is largely a matter of education of the public, but principally of ourselves. There must obtain mutuality and a common cause. Where this does exist, and the success of the industry as a whole is uppermost, individual successes follow as surely as the current flows wherever a conductor for it is supplied.

Provide that conductor and prevent the commercial suicide of the least of us, or all.

UTILITIES AS AN INVESTMENT.

BY LOUIS GUENTHER.

(This short article summarizes and reviews the showing made by some of the leading public service corporations during 1913, as indicating the growth, magnitude and soundness of this form of investment. The author is editor of the Financial World.—The Editors.)

Based upon the annual reports of earnings furnished The Financial World for the Fifth Annual Public Service Corporation Review by 286 of the leading companies for the fiscal year 1913, and which appear in that number, the showing made should prove gratifying to those interested in this field of enterprise.

The tabulated aggregated earnings reflect a healthful and normal increase in gross and net earnings, despite the fact that in other avenues of enterprise it has proven difficult to maintain earnings and profits up to a point where they would indicate no shrinkages as compared with the former year's business.

Gross earnings of these 286 companies for the year were $866,416,400, or $54,857,676 greater than a year ago. The percentage of increase was 6.76 per cent; net earnings were $370,801,186, a gain of $19,492,267, or 5.55 per cent; and surplus after all allowances for fixed charges and dividends, was $81,113,567, a gain of $2,655,893, or 3.54 per cent.

During the year these 286 companies disbursed to investors in interest on bonds, including all other charges, $150,223,407, which was $10,787,446, or 7.73 per cent, more than a year ago, and in dividends there was paid $130,777,354, which amount was $5,881,041 greater than in 1912, or a gain of 4.72 per cent.

From the above tabulation it is apparent that the public service corporations in every respect have forged ahead both in gross and net revenues and in the profits and interest they have been able to divide with those whose capital has made their financing possible and successful. While the surplus over all charges and dividends shows a smaller ratio of increase, this is due to the fact that during the year the 286 companies increased their bonded debt by $87,820,793, the charges on which absorbed profits and cut into the surplus account.

This increased indebtedness was incurred principally for improvements and extensions which have not yet had an opportunity to develop additional traffic and revenues, but when they get fairly into play they are expected to add proportionately to the revenues of the companies.

What should attract the most marked attention is the vast amount of capital invested in this class of enterprises and which can be taken as a reliable indicia of the prominent position these companies occupy in the development of our country.

Our statistics indicate that the 286 companies have outstanding $2,151,842,261 in bonds. This is $87,820,793 more than in 1912; a total of preferred stock of $592,007,950, which is $18,821,721 greater, and common stock of $2,216,766,418, or an increase of $38,392,053.

Here is a total investment in these public service corporation enterprises, covering gas, electric light and power, telephone and telegraph and street railway, as well as interurban transportation corporations, of over $4,900,000,000.

No stronger proof could be asked for or furnished to support the argument that, next to the steam railroads, the greatest volume of capital has flowed into public service enterprises. The fact that the business has steadily developed into larger proportions with each year has shown the wisdom of this form of investment.

Of all industries none has evidenced a better ability to withstand adversity than public service enterprises.

The new transisthmian transmission line on the west side of the railroad, between Gatun and Cristobal, has, in part, been placed in service, in substitution for the former 6600 volt transmission line between the steam generating station on the west side of Gatun Locks and the transformer substation at Cristobal. The current is generated at 2200 volts and stepped-up, through transformers, to 6600 volts for transmission. At the present Cristobal station it is reduced to 2200 volts for primary distribution, the various local circuits receiving it through a smaller pole-line type of transformers, which step the pressure down to 220, or 110 volts, as desired.

A special gas burner for foundry use, built by Superintendent Flanders of the Everett Gas Company, promises to be of great benefit to the foundries and to increase the loads of gas companies in the Northwest. All foundries in that section of the country ignite coke in a cupola with a wood fire at the base. This requires the time of one man to split the wood and make kindling for the purpose. It also takes an hour to light the coke before the air blast can be turned on. By using a gas burner with high pressure air, the cupola is filled with coke and ore, the special gas burner inserted in the "take-off hole," and the coke is fully ignited within 25 min., the gas burner consuming approximately 1000 ft. of gas per hour. It is believed that this burner will make it desirable for the foundries to use a considerable quantity of gas.

Scientific management substitutes theory, which is the accumulated and systematized experience of many, for empiricism, which is the more or less shrewd guess-work of the experienced individual. As applied to manufacturing it has five organic functions: (1) Design (originates), (2) Equipment (provides conditions), (3) Control (specifies duties and gives orders), (4) Comparison (measures records and compares), (5) Operation (makes). Each of these functions are regulated by the three laws of effort: (1) Experience must be systematically accumulated and applied, (2) Effort must be divided, co-ordinated, conserved and remunerated, (3) Personal effectiveness must be promoted. Wherever a duty has a justification for existing it must be for the purpose of serving one of the five functions and is subject to the laws of effort.—A Hamilton Church in "Greater Efficiency."

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ERRATA NOTICE.

In the table showing relation of velocity to head on p. 352 in Geo. J. Henry's article on "Water Conduits" in the issue of March 25, the first 3 values for h should be placed at the end of the column.

Popularity Pandering

None will dispute the educational value of the popular press, but all will view with regret its bending with the bender to remove, if possible, the private utility corporation, as such, and to place in its stead the "service" of questionable economic advantage rendered by public ownership.

Only that which can, and ought to be, transmitted to writing should be published by any periodical. Accuracy is the prime essential.

But popular magazines, in their endeavor to cater to the passing fancy sometimes ignore this and create artificial conditions calculated only to hold interest until the magazine is sold. This results in the founding of the fictitious and the expression of the fanciful and fleeting.

And because these magazines are what they are, the reader is often lost in that zone of intellects' unfolding twilight where fact is separated from fiction; but it is a light too, in which one is unfortunately often mistaken for the other, and a lie takes on the semblance of truth.

The summation of the whole matter is, that popularity pandering creates the appeal only and not the proof. It is an invitation to investigate further.

* * * * * * *

A recent popular magazine article states that "Nothing is more characteristic of our privately owned railroads than their wrecks which are part of the sins the roads cannot hide from us." It mentions the existence of "secret sins which the railroads do hide," and then refers to the creation of desert wastes into forest reserves and Indian reservations in the interests of the railroads, and a mulcting by them of the people's millions.

This is advanced as one of the arguments in favor of public ownership.

Railroad companies have had their peculiar and important problems of rapid growth and expansion, of finance and legislation, yet with all this they have found time to devote a lot of attention to the question of safety—first, last and all the time.

It is true that there have been exceptions but the prominence given these when accidents have occurred or irregularities have been discovered, merely emphasizes the rule of the railroad's considerateness of its patrons—the traveling public.

Safety with the railroads is an economic necessity, and consideration of the fact that our railroads handle, in the rendering of a desired standard of service—comfort and high speed—the heaviest rapidly moving machinery known, the accidents which do occur are comparatively few.

The railroad companies are rapidly adopting newly invented devices for the protection of life and their effort in this direction is meeting with an appreciable reduction in the number of accidents.

In this connection reference may be made to the Southern Pacific Company and its remarkable record, referred to in a previous editorial. The article in this

issue by Mr. Lebenbaum goes to at once show the sane conservatism, yet progressiveness of the company in its desire to protect its passengers.

In such sweeping statements as that made in the popular magazine article referred to, this company is also included and this is certainly not just. It labels the article superficial and untrue.

And, incidentally, that government officialdom and manipulation had parted in land values with millions of the people's money without expectation of return, seems an absurd argument to advance in favor of public ownership.

Have you any assurance that administration of other public properties—railroads, telephone, telegraph, electric light, power and gas plants—by the government, would be more free from manipulation and such enormous public loss?

* * * * * * *

Yet there are some utility corporations who push the sale of popular magazines with their menace of publicity pandering and false education and who fail to see their need for supporting those trade periodicals and technical journals which at least analyze these matters conscientiously and speak of things as they are.

Effectiveness

Efficiency is but a conservation which makes effectiveness possible. Effectiveness embraces efficiency but the efficient is not necessarily effective. The efficiency of a lamp, for example, may be but one factor in the effectiveness of the illumination, and similarly the efficiency of the reflector is dependent upon its proper installation with reference to the lamp, and of the complete unit to the work to be accomplished. Successful accomplishment, results count, and the real measure of worth is found to be effectiveness.

The most efficient lamp is one burning at a voltage most conducive to its operating value and without any auxiliary equipment, but it is not effective.

As with lighting so with individuals—efficiency without effectiveness is loss. So you have the seemingly absurd situation of ineffective efficiency.

In the illustration given the lamp was most efficient, that is with regard to maximum output, or performance, but because so much of the lighting or work done was in unnecessary places, the lamp was inefficient; an efficient lamp inefficient because not effective.

To be competent; to go into the minutest detail; to have all the ability, reliability and power necessary, is alone not enough though to possess these is to be efficient. An efficient is a qualified person, but qualification without intelligent application—knowledge without right use—is of no value.

It is maximum effectiveness which is most desirable in all things.

Suspended above a dining-room table the bare lamp would be undesirable, but equipped with a dome or indirect bowl and it would be at once pleasing and although less efficient, of more value because effective. The light has been concentrated, controlled, and put to a right use.

With individual endeavor the results are again similar. There is a seeming loss while the concentraing and gathering together of resources is in process, and to the near-sighted control is also a loss; but the broader view shows that the candle cannot be burned at both ends or allowed to dissipate its energy in all directions.

Such light, though it uncovers the detail of the darkest corner does not accomplish the most complete service because so much of the energy expended in this form of lighting is wasted.

Concentration, control and right use are essential.

So, with the thought implied, the word "effective" is proposed for your consideration in place of that overworked word "efficiency," as a further step toward realization of the principle which the advocates of efficiency have purposed to convey.

Why not aim at effectiveness—results?

Specialties and Staples

It is a simple matter to sell staples, specialties and new lines in the territory sold need more strenuous endeavor. In the first case, the market is established, and through advertising, the goods almost sell themselves, irrespective of who gets the business, while in the latter case the market has to be created in this case the business being almost invariably secured by the creator of the market.

But staples are the foundation of business continuity and are essential, though it is inadvisable to get into a business rut. The problem is, how best to appreciate the business in staples and yet not get into a rut. A rut has been described as "a grave, only longer."

To air another aphorism: Hard times are for those who think hard times.

For the business man who would think hard at times, the story is different.

The great value of invention to business is that it proves an equalizer of the market, lowering the business peaks of impossible accomplishment and filling the valleys of business depression with the new.

Inventors rely upon the artists for the commercialization of their ideas and the artists depend in turn upon the workers for the carrying out of their projects.

Invention benefits all.

The situation may be compared to the play. The play's the thing of the inventor's mind; the stage setting and production the work of artist manager, and the actors the actual workers.

The suggestion for distributors, dealers and contractors contained in the foregoing is: When times are "hard," concentrate on specialties and the new, and when business is good, turn to staples—the "new" things which have established themselves.

New devices, new lamps, new fittings and fixtures, are continually displayed for the improvement of the gas and electrical businesses. And the only logical advice is: Do not wait for the specialties to become staples, but use them while novel in the interests of increased business and improved service, and so fill up the valleys of business depression.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

J. O. Presbey, representative of the Holophane Company, is at Salt Lake City.

G. R. Gillespie of the Gillespie Mine Company, Sierra City, Cal., was a San Francisco visitor last week.

J. A. Ulmer of the Ulmer Machinery Company, Porterville, Cal., was a recent visitor at San Francisco.

F. F. Skeel, salesmanager of the Crouse-Hinds Company, Chicago, Ill., spent a few days at Seattle last week.

Lester I. Brown has been appointed secretary of the Bloomfield Mutual Telephone Company, Bloomfield, Montana.

L. F. Youdall of the Electric Equipment & Machine Company, Stockton, Cal., was at San Francisco during the past week.

L. A. Somers of the industrial and power department, Westinghouse Electric & Manufacturing Company, is at Stockton, Cal.

George R. Cooley, electrical engineer of the firm of Buxbaum & Cooley, has been elected a member of the city council of Seattle to fill a recent vacancy.

D. Havey, formerly city salesman Electric Appliance Company, has left on his initial trip through the Nevada territory to which he has been transferred.

H. B. Vanzwoll, of the Sunbeam Lamp Works of the General Electric Company, is at Seattle from Salt Lake City, and will visit other cities on the Pacific Coast.

Robert E. Strahorn, president of the Portland, Eugene & Eastern Railroad, has returned to Portland, Ore., from an extended trip through California, Nevada and Utah.

J. H. Parker of the J. H. Parker Company, Chelsea, Mass., is visiting Pacific Coast cities in the interests of Eastern porcelain manufacturers and the electric insulator business.

H. L. Parker of The Emerson Electric Manufacturing Company, St. Louis, Mo., stopped off at San Francisco for a few days on his way East from a trip made to the Hawaiian Islands.

Walter W. Brown, until recently city specialty salesman, with the Electric Appliance Company, resigned in order to engage in business at Modesto, Cal., with the Industrial Service Company.

F. D. Fagan, sales manager, San Francisco office Edison Lamp Warks of General Electric Company, is at the Merritt Hospital, Oakland, Cal., making rapid recovery from a recent operation.

E. C. Gaumnitz, purchasing agent of the Puget Sound Traction, Light & Power Company of Seattle, has resigned and has been succeeded by **F. H. Hamilton**, formerly traffic agent for the company.

H. F. Yost, formerly traveling representative of the Electric Appliance Company in Nevada, has severed his connection with the company and is opening an up-to-date electrical store at Sacramento.

W. A. Moser of the Utah office of the Westinghouse Electric & Manufacturing Company, has gone back to the factory at Pittsburg for a two months' stay on some special work for his company.

T. E. Collins of the Westinghouse Electric & Manufacturing Company, was at Fresno and attended the funeral of **W. N. Peart** of the San Joaquin Light & Power Company, who was drowned on March 28, 1914, but whose body was not discovered until last week.

J. H. Moseley, formerly with the advertising department of this journal and recently of the appliance department of the Pacific Gas & Electric Company, has decided to remain in the East and has accepted a position with the Texas Light & Power Company, Dallas, Tex.

W. F. Durand, professor of mechanical engineering at Stanford University; **J. D. Galloway** and **F. G. Baum**, consulting engineers at San Francisco, have been appointed as a board of hydroelectric engineers to advise on plans for the first electric power development in the Hetch-Hetchy water supply system.

Tsunesada Samukawa, consulting electrical engineer at Tokyo, Japan, is making a study of hydroelectric conditions in America. During the past week he visited several of the California plants in company with **Tamotsu Hirota**, with Mitsui & Co. From California Mr. Samukawa will proceed to New York by way of Keokuk, returning to the Pacific Coast by the northern route.

H. D. Curran, of the Curran Electric Sign Company of Spokane, Washington, was a Salt Lake City visitor last week. Mr. Curran has recently made a complete tour of the East, inspecting all of the sign manufacturers and signs of importance, looking for ideas to put into his work in Spokane.

J. A. Briggs Jr., consulting engineer, room 228 Laughlin Building, Los Angeles, Cal., has been elected a member of the American Society of Civil Engineers. Other recently elected western members are: **F. F. Hall**, 25 Hillside Court, Berkeley, Cal.; **Ray Emerson Koon**, hydraulic and sanitary engineer, Portland, Oregon, and **James Bond Pope**, assistant engineer, Southern Pacific Company, Flood Building, San Francisco. The following have been elected associate members of the society; **P. H. Albright**, consulting engineer, 334 Consolidated Realty Building, Los Angeles, Cal.; **Harold Conkling**, assistant engineer U. S. Reclamation Service, Boise, Idaho, and **T. D. B. Groner**, assistant engineer Oregon Short Line, Salt Lake City, Utah.

J. W. Finch has resigned as commercial agent with The Southern Sierras Power Company at Riverside, Cal., to contract on engineering construction. He has already secured the contract for the 33,000 volt transmission line from the main line of The Southern Sierras Power Company on the Mojave Desert, through the towns of Victorville and Oro Grande. Another important contract which Mr. Finch has closed and upon which active work will be commenced immediately, is a 55,000 volt transmission line, extending from Banning, Cal., to El Centro, Cal., for the Coachella Valley Ice & Electric Company, which company serves current for the Imperial Valley. This line is to be 131 miles in length, and when connected to the lines of The Southern Sierras Power Company will form the southern leg of the longest distributing power line in the world. The distance from the extreme northern terminus at Wonder, Nev., to El Centro is 586 miles.

MEETING NOTICES.

San Francisco Electrical Development and Jovian League.

The league met at the usual place last week, the after luncheon period being in charge of the Jovians. The coming rejuvenation, postponed from May to June 15th, was enthusiastically discussed and plans furthered assuring its success. W. S. Berry presided.

Seattle Engineers' Club.

The Seattle Engineers' Club met at luncheon at the College Club, Thursday, April 30th. W. G. Swart, president of the Western Association of Metallurgists and Chemists, who is at Seattle on a short visit, gave an interesting talk about mining conditions in the West as he has recently observed them.

Pacific Association of Scientific Societies.

Pacific Association of Scientific Societies will hold its fourth annual meeting at Seattle, May 21-23, 1914, both dates inclusive. Headquarters for the meetings will be at the University of Washington. The association includes the Geological Society of the Pacific Coast, H. B. Torrey, Reed College, Portland, and the Puget Sound Section of the American

Chemical Society, R. W. Clough, 4145 Arcade building, Seattle, and many other societies having headquarters in California.

Los Angeles Section, A. I. E. E.

The regular monthly meeting of the section, held at Blanchard Hall, on April 28th, was well attended. A lecture was delivered by Julian Adams of the Pacific Electric Railways on "Railway Substation Operation," which we shall publish in a subsequent issue. The discussion was participated in by Messrs. Northmore, Woodbury, MacDonald, Lynch, Nye, Loewenthal, Sorensen, Barrett, Miller, Dennett, Rogan and Cox. A report on the Pacific Coast convention to be held next September was read and it was decided that the Los Angeles Section present one paper at that convention.

The Jovian Electrical League of Southern California.

The weekly luncheon was held at Christopher's, Los Angeles, April 29th. City Superintendent of Schools J. H. Francis gave an after luncheon talk on "Education and Life." He made it clear to his hearers that education, to be really helpful, should be living, not only getting ready to live and that in order to insure this, education should be hitched to life itself. He described many of the educational innovations in the Los Angeles public schools, such as the new commercial course for store employes, in co-operation with the store owners; the giving of school credits for work done by pupils at home, such as cooking, music and gardening and thus linking the school to the home. He enumerated the following essentials as the most important ones in the training of our youth. Preserve the health, teach the relative value of getting and giving and instill the importance of staying power, character and a purpose in life. An interesting musical program was rendered by the recently organized Jovian quartette, consisting of Messrs. Young, Searle, Rand and Darrow. Carl C. Young was chairman of the day. A resolution was passed favoring the school bond issue, which will be voted for on May 14th.

Utah Electric Club.

At the regular meeting of the Utah Electric Club, Thursday, April 30th, C. D. Kipp presided in the absence of the regular chairman, C. C. Pratt, who was out of the city. President Torrence explained that the Electric Club had been invited by the Commercial Club of Salt Lake City to participate in a "Whirlwind Campaign" on that day, which has for its object the raising of a $40,000 publicity fund for Salt Lake City, to be expended during 1914. Ten of the principal clubs of the city had been invited to co-operate in this campaign, each agreeing to put in the field at least six teams of two men each. The Electric Club had responded heartily to the call of President Torrence for assistance, and seven teams were out working that had consisted of the following men:

H. F. Holland and W. D. Bowerman,
F. H. Barber and H. T. Plumb.
C. B. Hawley and B. W. Mendenhall.
Lloyd Garrison and F. C. Reinhart.
C. D. Kipp and R. S. Folland.
A. E. Smith and F. Rouston.
W. W. Torrence and Leo Brandenburger.

The committees had been at work all of that morning and were meeting with excellent results. It was freely predicted that the Electric Club would head the list of all of the ten clubs in the number and amount of subscriptions secured. When the final results of the day's work were checked up, however, it proved that the Ad Club had been assigned the banks of the city and had received one large contribution from all of the banks through the Clearing House Association, which threw the Electric Club into second place in the amount of subscriptions. They led by a large majority, however, in the number of subscriptions secured.

The speaker of the day was Lieutenant Cake of the U. S. Navy, who took as his subject the armament and electrical equipment of a battleship, and the part which electricity plays in its control and operation. Lieutenant Cake knows a battleship from stem to gudgeon, and explained the prominent part which electricity plays in the loading, aiming and firing of guns, the operation of turrets, ammunition hoists, signals and lighting, heating, cooking and ventilating. Lieutenant Wallace of the U. S. Army is scheduled as the speaker for next week and the senator engineers of the University of Utah have been invited to attend the luncheon as guests of the club.

IDAHO PUBLIC UTILITIES COMMISSION.

The Washington Water Power Company was granted a certificate of public convenience and necessity for the construction and maintenance of transmission lines on all the roads of Latah county, Idaho, with the right to furnish all the residents with electricity. The company, during construction of its lines and until the same are finally completed, is required to keep account of all expenditures made and immediately after the completion of the line to file with the commission the account and a report on the construction.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The commission has arranged with the Pacific Telephone & Telegraph Company for the installation in apartment houses of individual telephone service. The matter came to the attention of the commission on the complaint of J. W. White of No. 1030 Post street, San Francisco, who represented that he was limited to service through the apartment house system.

The commission has rendered a decision authorizing the transfer of the plant and distributing system of the Sunnyvale Water Company, operating in Sunnyvale, Santa Clara county, to the town of Sunnyvale for the sum of $16,039.67. The figure is the original cost without deduction for depreciation.

The Sierra Madre Water Company, having its principal place of business at the city of Sierra Madre, Los Angeles county, has filed an application with the commission for authority to sell its system to the city of Sierra Madre for the sum of $96,000.

The commission has rendered a decision in which it finds that the rates charged and collected by the California Natural Gas Company at Bakersfield are unjust and unreasonable, the commission finding that a reasonable rate to be charged by the California Natural Gas Company to the Bakersfield Gas & Electric Company, which is the distributing concern, is $.1275 per 1000 cu. ft. on a 4 oz. basis. The commission also orders that the company shall collect a rate of $.07 per 100 cu. ft. on a 4 oz. basis for all excess natural gas, which is not used by domestic consumers, but is delivered to the Bakersfield Gas & Electric Company for the purposes of the steam plant of the San Joaquin Light & Power Corporation.

NEW CATALOGUES.

Full electric fan details are given in a booklet recently issued by the Sprague Works of General Electric Company.

D. & W. Fuse Company, Providence, R. I., has just issued Circular 150 dealing with Oil Fuse Cutouts for high tension work.

The Exide Charging Systems for Garages is fully described in a booklet now being distributed by The Electric Storage Battery Company, Philadelphia, Pa.

The new nitrogen filled lamp is described in Bulletin No. 43600 of the Edison Lamp Works of General Electric Company. Modern lighting practice in the clothing industry is fully detailed in Bulletin No. 43401 of the same company.

The Lighting of Woodworking Plants is the title of Bulletin No. 43400 just issued by the Edison Lamp Works of General Electric Company. Bulletin No. 43402 of the same company deals with the lighting of machine shops and metal-working plants.

CALIFORNIA ASSOCIATION OF ELECTRICAL INSPECTORS

Section of N. A. E. I.

C. W. Mitchell, President. Arthur Kempston.
Wm. G. Pennycook, Vice-Pres. B. C. Hill, Executive Comm.
John W. Carrell Secretary-Treasurer, 55 Fulton, San Francisco.

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correllate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

HAZARDS DUE TO STRAY ELECTRIC CURRENTS.

By the Secretary.

A force, properly controlled, may be of great commercial value; but, when not controlled, may prove destructive. The same quality of the electric current which is the hasis of electro-chemistry and which is largely used in electro-metallurgy has, (as stray currents) caused disastrous gas explosions and has weakened the structure of underground piping; the latter a serious fault, especially where high pressure water systems are used for fire fighting purposes. Stray currents may also cause arcing hetween gas and water pipes in buildings. The following facts regarding electrolysis are well estahlished. An electric current, where the circuit is completed through liquid from metal terminals, will cause the positive terminal to decompose; will cause the attacking agencies in the liquid to flow against the direction of the current to the positive terminal; may disintegrate iron in continuously wet earth at the rate of 100 lb. per year for a current of 6 amp.

Electric currents for street railway systems leave the generators to the overhead trolley wires, thence through the mechanism of the car to the rails and are presumed to return through the rails to the generator; hut rails do not always offer ample conductivity for a free passage of the return current. Rail bonds may be defective; sufficient copper to reinforce the conductivity of the rails may not have been provided, and some of the current will then find a better passage through the earth and particularly through underground piping systems. Water and gas pipes offer a good avenue for these return currents; mayhe the path for many amperes at a potential considerably above that of the surrounding earth. The danger lies in the fact that the current must leave the pipes to return to the generators.

At the point where the current leaves the metal pipes, through the earth, and "jumps" to other piping systems, or back to the rails, or to any point to which it is positive, corrosion occurs, due to electrolysis. This action will weaken or destroy the structure of the pipe in proportion to the current which flows and with respect to the conducting medium. Stray currents may enter huildings through one system of piping and return through another, or one system may be changed to a potential above and arc to other piping with which it is in contact, but not electrically bonded, during vihration.

The remedy is the use of sufficient copper to reinforce the conductivity of the rails so that the extreme difference in potential between the grounded terminal and any point in the return circuit shall not exceed a reasonahle voltage, and that a suitable path of copper be provided for current to "leave" the pipes.

It may he well to mention here that the National Electric Code permits the grounding of low-potential (complete metallic) circuits only when such circuits are so arranged that under normal conditions of service there will be no appreciable passage of current over the ground wire. These wires may be attached to piping systems in the full confidence that the integrity of such piping systems will not be in any way affected no matter what the normal voltage may be.

TRADE NOTES.

The wiring of the new Carnegie Library at Renton, Wash., was recently let to the Wahlgren Electric Company of Everett, Wash.

The Electro-Alkaline Company, Oakland, Cal., has signed contracts for the entire output of its new plant which has just been completed.

The wiring of the Jaffe Building, at the corner of Second and Madison streets, Seattle, was let this week to NePage-McKenny & Company.

H. W. Johns-Manville Company, New York and Seattle, has been awarded the lighting contract for the new terminal station at Spokane, Wash.

The Independent Electric Company has been awarded the contract for the electrical wiring of the warehouse now being erected hy the Continental Oil Company.

The San Francisco office of the U. S. Forest Service has moved to the Adam Grant Building, 114 Sansome street, corner of Bush. The change was made on account of the need for increased space.

At a special meeting of the commission of public docks at Portland, Ore., the General Electric Company was awarded the contract for furnishing power equipment on Municipal Dock No. 1, the bid being $2598.15.

The C. B. Lumber & Shingle Company of Everett, Wash., recently placed an order with the General Electric Company of Seattle, for a 312 kw. engine driven generator complete with switchboard and 350 h.p. motor.

The Western Electric Company has secured an order for 120,000 lb. of telephone cable from the Kitsap County Telephone & Telegraph Company, and the Angeles Telephone & Telegraph Company, Seattle, Washington.

The generator being installed by S. S. Bullis at Medford, Ore., is a G. E. 800 kw., and the waterwheel which is being supplied through Geo. J. Henry, hydraulic engineer, San Francisco, operates under about 750 ft. head.

The American District Steam Company is to entertain the delegates of the Sixth Annual Convention of the National District Heating Association, which is to be held at the Seneca Hotel, Rochester, N. Y., May 25-29, hoth dates inclusive. The special entertainment will consist of a visit to the company's plant, sight-seeing at Niagara Falls, and a dinner at the Cliftonville Hotel on the Canadian side.

The general offices of The United States Light & Heating Company at 30 Church street, New York City, will be moved on May 20, 1914, and located thereafter at the company's plant, Niagara Falls, New York. Ths transfer will result in bringing together the administrative, sales, engineering and production departments and will insure the most effective conduct of all in the interests alike of patrons and stockholders.

BOOK REVIEWS.

Legal Requirements for Overhead Construction in California; interpreted by J. E. Macdonald; 12 p.p.; size 5x7 in. Published by the Technical Publishing Company, and for sale by the Technical Book Shop, Rialto Building, San Francisco, Price 10 cents.

The text and complete diagrams are for the guidance of those interested in the construction and maintenance of the various California electrical distribution systems. It is not claimed that this pamphlet contains all that is implied in the statute (Chapter 499, Cal. 1911), but it is an analysis and brief exposition of what many engineers have agreed to be its intent and purpose. As such it should be in the hands of all interested.

INDUSTRIAL

NEW FIXTURES FOR NEW LAMPS.

A number of new fixtures adapted for use with the Type "C" Mazda lamp have been placed upon the market by the Benjamin Electric Manufacturing Company of Chicago, and these are illustrated herewith.

Fig. 1 shows a form with shallow bowl reflector and surmounting hood of enameled steel. Fig. 2 illustrates an enclosed form with 12 x 8 in. Alabaster globe. For outdoor service a copper holder and hood finished in black, oxidized copper is furnished; for indoor service brushed brass holder and hood. This globe is particularly adapted for Type "C" lamps in that it has the proper density to secure a minimum absorption of light without allowing the lamp filament to become visible. The method of hooding protects the lamp against rain and snow. Ample ventilation is provided. The fixture shown in Fig. 3 is substantially that shown in Fig. 2, but with 13 in. chain support and canopy.



Fig. 1.



Fig. 2.



Fig. 5.



Fig. 3.

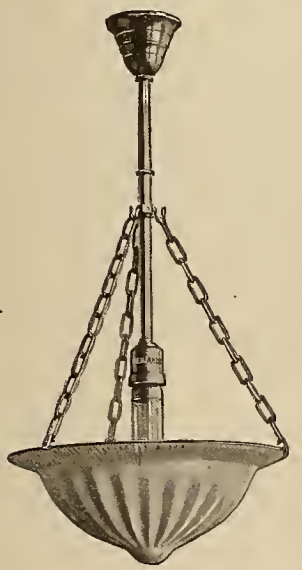


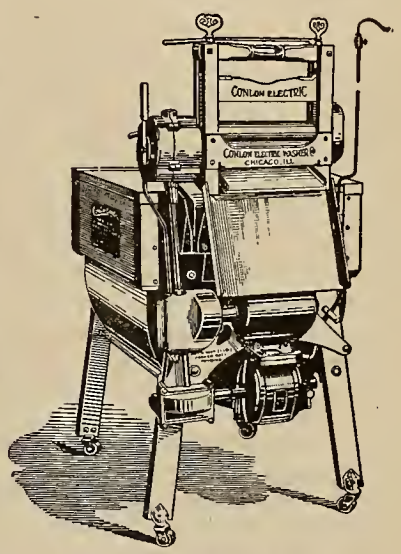
Fig. 4.

Other designs ready for the trade include an indirect unit with a fluted enameled steel reflector which distributes the light in useful directions without being intercepted by the globe. This eliminates approximately 12 per cent of bulb absorption, and avoids shadows generally caused by suspension chains (Fig. 4); and a 13 and 15 in. enameled steel reflector with ventilated hood attached before enameling (Fig. 5). A number of mogul base sockets have also been provided.

All of these fixtures are equipped with the Benjamin lamp grip for preventing the loosening and falling of lamps.

A FEATURE WASHING MACHINE.

An electric washer must be safe—"Fool Proof." In the Conlon Electric Washer here illustrated every piece of mechanism down to the smallest gear is encased and located in space which could not otherwise be used. In this way the operator does not come into contact with any of the moving parts. It is simple in operation, reliable and sanitary. The body is made of the best galvanized steel or copper as desired. The metal extends to the top of the machine, leaving no crevices or ledges on the inside to collect or absorb dirty water and soap. It is equipped with a guaranteed motor especially designed for washing machine use.



View Showing Special Features.

An alliance has been formed between the Conlon Washer Machine Company of Chicago and the Western Electric Company. Under the arrangements, the entire line will be marketed by the Western Electric Company under the trade name of the "Western Elecric-Conlon." This selling arrangements involves no changes in the manufactory. Ample stocks will be carried at each of the twenty-eight Western Electric distributing houses located at shipping centers throughout the United States.

Holabird-Reynolds Electric Company of Los Angeles are the exclusive representatives of the Conlon Electric Washer Company for Southern California.

The Conlon washer is well known to the electrical trade in general and is looked upon with particular favor by the central stations.

NEW PUBLICATIONS.

Regulation of Public Service Companies in Great Britain is the subject of a 231 page report of R. W. Whitten, published as a reprint of appendix G of the annual report of the Public Service Commission for the first district of New York. Dr. Whitten treats phases of the subject that offer suggestions for the solution of the American problem. Much space is devoted to the sliding scale system of rates and to the "merit rating method" by which companies are rated on the basis of comparative efficiency in serving the public and allowed to earn dividends varying with such efficiency.

NEWS NOTES

INCORPORATIONS.

BAKERSFIELD, CAL.—Midway Gas Company, $3,000,000, by C. P. Ellis, R. Girkin, K. Moore, R. Berliner, et al.

RENO, NEV.—Nevada Interurban Telephone Company, $50,000 shares, $1 each, by O. C. Bates, A. G. Burton, et al.

MESA, ARIZ.—Articles of incorporation of the Phoenix Machine & Cold Storage Company have been filed by Hos. Thalheimer, P. T. Hurley, S. J. Tribolet, Melzzer Bros. Co., Alex Rhienstein & Co., W. C. Dawes, Wakelin Grocery Co., et al., with a capital stock of $50,000. The company proposes to deal in ice refrigerating machinery, supplies and stores, goods, wares and merchandise of every class; also to acquire an electric light and power plant to furnish its own power, light, etc.

ILLUMINATION.

RIALTO, CAL.—The Rialto Light, Power & Water Company has been granted a franchise to construct and operate for 50 years, an electrical pole, wire and tower system in this city.

FORNIE, B. C.—The city will install a complete tungsten street lighting system covering a circuit of 100 miles and using lamps of 100 c.p. Regulators and panel boards for the control of this series system were also included in the contract.

AUBURN, WASH.—J. L. Veach, of the firm of Veach & Abraham, and stated to be representing the Auburn Gas Company, has applied for a 25-year franchise to operate mains through the city.

LOS ANGELES, CAL.—The city council has ordered necessary lighting posts and appliances to be installed, and furnishing of electric current for lighting same, of Short Line Villa tract in Los Angeles city.

GLENDALE, ARIZ.—The city council has authorized City Attorney Frank Lyman to prepare an ordinance authorizing an issue of $4000, 20 year bonds to be sold as needed for future construction of the electric light plant.

HUNTINGTON PARK, CAL.—The Western Construction Company of Los Angeles has been awarded the contract for wiring of Huntington Park's lighting system. The price was $3174.77, this includes wires and work necessary, with exception of iron posts, which are to be secured by the city under another bid.

SEATTLE, WASH.—In denying the petition of Albert Chandler for an injunction restraining the city from issuing $400,000 worth of Cedar river dam bonds and $400,000 in bonds for an emergency steam plant for the city light and power service, Judge R. B. Albertson confirmed the city's right to engage in supplying electric power as a by product of the city light plant.

VANCOUVER, B. C.—The installation of ornamental lights on Seymour street from Robson to Cordova has been recommended by the civic fire and police committee. The light standards would cost $12,560, according to an estimate of City Electrician Fletcher and would cost $3625 a year to maintain. The Georgia street standards would cost $32,784 to install and $9260 to maintain for a year.

PORTLAND, ORE.—Under protest the Portland Gas & Coke Company filed with City Treasurer Adams a statement of its gross earnings for 1913, which total $1,222,883. This statement is required by an initiative ordinance passed by the voters of 1911, to the effect that electric light and power and gas companies operating in this city under a franchise shall pay to the city annually 3 per cent of their gross earnings. The company has refused to remit to the city the 3 per cent gross tax until the validity of the ordinance is settled in the supreme court, to which the case has been appealed.

OGDEN, UTAH.—Committees from the Weber Club of this city are working actively with the property owners on Twenty-fourth street between Washington and Wall avenues for the purpose of securing their subscription to a special lighting system which it is proposed to install on that street. The Weber Club has entered into an arrangement with the Ogden Rapid Transit Company, the Utah Power & Light Company, and the city, whereby the transit company will furnish the trolley poles and the property owners will pay for the installation of a special street lighting system thereon, using luminous arc lamps, and the city will pay for the cost of the lighting after the system is completed.

LEHI, UTAH.—The city council have granted a fifty year franchise to C. W. Earl of Salt Lake City to construct, maintain and operate in Lehi City an electric distributing system for the purpose of supplying the city with electrical energy for lighting, heating and power purposes. The franchise provides for the following maximum rates:

Municipal street lighting by arc lamps	$3.75 per arc per mo.
Arc Lighting to private parties:	
For all night service	$3.75 per arc per mo.
For midnight service	2.00 per arc per mo.
Incandescent lighting	.08 per kw.-hr.
Minimum charge	1.00

The city retains the right to purchase the plant after ten years, by appraisement, if a satisfactory price cannot be agreed upon.

SAN FRANCISCO, CAL.—The state supreme court was asked for a rehearing of the Oro electric case in a petition filed by the state railroad commission, the Pacific Gas & Electric Company and the Southern California Edison Company. The supreme court in a decision several weeks ago denied to the commission the power to protect from competition a public service corporation subject to its regulations. The petition is remarkable because of the conjunction of interests that find themselves agreed to fight for more power for the railroad commission. "We take the position that if rates are to be cut down by the railroad commission and regulation carried to the point of fixing a certain rate of revenue, then the regulated companies must be protected in their field from competition," said Charles P. Cutten, attorney for the Pacific Gas & Electric Company

TRANSMISSION.

PHILLIPSBURG, MONT.—The Roya Basin Mining Company has decided to erect an electric power plant on Flint Creek, a short distance below the town of Maxville.

TUCSON, ARIZ.—Work on the construction of a power line through the Rillito River section will be started in a short time by the Tucson, Gas, Electric Light & Power Company, power to be used by ranchers for pumping purposes.

CANYON CITY, ORE.—David A. McKeown of Prairie City has filed with State Engineer Lewis an application for a permit to appropriate additional water from Strawberry Creek. He proposes to enlarge his present appropriation and develop additional power to the extent of 1527 h.p. The application provides for 15 cu. ft. of water per second, with a fall of 790 ft.

LAKEVIEW, ORE.—C. H. McKendree returned from San Francisco recently, where he went to complete filings on the

water rights of the Fall River power project, which he has been working on for some time. Mr. McKendree now has established prior rights to the project for the next 12 months, which, he thinks, will give ample time to complete arrangements for financing its construction.

SALT LAKE CITY, UTAH.—The Utah Light & Railway Company has purchased the property adjoining its general office building on West Temple street, the consideration being stated at $66,000. The property has a frontage of 82 ft. on West Temple, and a depth of 165 ft. The property occupied by the present general office of the company has approximately the same frontage and depth. While it is stated by the officers of the company that no improvements are expected to be made on this property in the immediate future, it is generally supposed that it was acquired for the purpose of enlarging its general offices at some time in the future to take care of the rapidly growing business.

LOS ANGELES, CAL.—The legality of the proceedings authorizing the submitting of the proposed $6,500,000 bond issue for acquiring or constructing electric works and distributing system having been questioned by attorneys and others, the city council has authorized City Attorney Stephens to employ Dillon, Thomson & Clay, bond attorneys of New York, to investigate and pass upon the validity of the council resolution and of the bonds, if carried. The proceedings have been attacked on the ground that they do not sufficiently specify for what purpose the money is to be used. Aside from the question of legality, many taxpayers object to the concealment of the true situation with reference to the manner in which the proceeds of the bonds could be spent. It is pointed out that if the bonds are voted and sold the city council could spend $6,500,000 for the acquisition or construction of a distributing system without spending any of the money on the completion of the power works and the taxpayers would have little, if any, remedy.

TRANSPORTATION.

PORT ANGELES, WASH.—An ordinance has been passed granting to the Seattle, Port Angeles & Lake Crescent Railway authority to construct and operate a railway over certain streets and alleys in Port Angeles.

LOS ANGELES, CAL.—The board of public utilities has adopted a resolution directing the Los Angeles Railway to complete its line on Vernon avenue, and to install an interlocking apparatus at Long Beach avenue crossing the Pacific Electric.

SAN FRANCISCO, CAL.—The United Railroads began last Friday to operate the new extension of the Polk and Larkin streets line near the Exposition grounds. Hitherto the terminus was at Lombard street. It has now been placed at Bay street.

GLOBE, ARIZ.—An ordinance granting to the Globe & Miami Traction Company, a franchise to build and operate a street railway upon certain streets in Globe, will be submitted to the voters of the city at the general election, to be held May 25th.

SAN FRANCISCO, CAL.—The revenues of the municipal street car system will be increased this month by $1000, which is the first installment on its advertising contract. A New York firm agreed to pay the city $108 a car per year for the advertising space.

SAN DIEGO, CAL.—The city council has granted the applications of the San Diego Electric Railway Company for the sale of franchises for extensions on F and Laurel streets, and for permission to absorb the Point Loma Railway Company. The F and Laurel street franchises will be advertised for sale, bids to be opened June 1.

SAN FRANCISCO, CAL.—The Civil Service Commission and Superintendent Cashin of the Municipal Railway are conferring in relation to the examination which is to be held this month for platform men for the new railway lines that the city is building. Several hundred conductors and motormen will be required.

SALT LAKE CITY, UTAH.—R. S. Campbell has presented an application to the city commission for a franchise to construct and lay conduits throughout the commercial district for a heating and power distribution plant and system. Mr. Campbell states that he believes a central heating plant will do much toward solving the smoke problem which has become so serious in this city during the last few years, and claims that he and his associates will incorporate a company to be known as "The Citizen's Public Utility Company" to install and operate the system.

SAN BERNARDINO, CAL.—The Southern Sierras Power Company has material on the ground for a power line down the Imperial Valley as far as El Centro, and the work is expected to begin at once. The power comes from Inyo county to San Bernardino, a distance of 586 miles. This development of electric power is creating a new way of locomotion in the state in the trackless trolley. One is planned from a station in the Cajon Pass to Big Pines resort, twelve miles up on the slopes of Mt. San Antonio. This is a popular summer resort, and the line is expected to be ready for service during the summer season.

SAN FRANCISCO, CAL.—As the result of a request from the public utilities committee that the street railway service be improved on Fillmore street for the accommodation of the crowds going to the Exposition, a plan has been developed by General Manager Black of the United Railroads for lowering the heavy Fillmore street electric cars down the steep incline. Black states that by increasing the size and strength of the present cable appliances on the Fillmore street grade the big cars can be lowered down the two blocks from Broadway to Green street. From Green to Filbert street, however, he says that there would have to be a trestle over Union street. The plan will be submitted to the public utilities committee. This arrangement would make transferring from Union to Fillmore street inconvenient, but Black says in this regard that as soon as the city's Van Ness avenue line is in operation that transferring at this point will be discontinued. He claims that the United Railroads is carrying passengers between the Union street and Geary street lines free of charge and that it is costing the company between $5000 and $7000 a month.

TELEPHONE AND TELEGRAPH.

PORT ANGELES, WASH.—A telephone franchise has been granted to C. J. Farmer.

HOUSE, N. M.—Citizens of House are considering the question of getting connection with the telephone line now being built to many parts of Quay county.

EUGENE, ORE.—F. H. Tivey, Emmerson Eichler and Clude Mitchell, farmers, have applied to the county court for a franchise for a pole line from the city limits along the county road to their farms.

ALAMEDA, CAL.—The city council has decided to offer the Pacific Telephone & Telegraph Company a 30 year franchise conditioned on payment to the city of 2 per cent of the gross receipts and the furnishing of 40 free telephones.

BERKELEY, CAL.—Pending disposition in the supreme court of the suit filed by the city of Berkeley against the

Pacific Telephone & Telegraph Company, seeking the dissolution of the merger of that corporation and the Home Telephone Company, officials of the former company have submitted a proposiion in which they agree to pay to the college city 2 per cent of the gross earnings each year in Berkeley until the expiration of the old Pacific States franchise, four years hence. The proposition, which is identical to the one which Oakland accepted in settlement of its suit, has been taken under advisement by the city council. Berkeley lost its suit in the superior court several months ago and appealed.

LOS ANGELES, CAL.—The city will be engaged in a legal test with the Pacific and Home Telephone companies, because of the action of the board of public utilities commission, in rate fixing, should the city council sustain its action. The commission decided that the telephone rates for the next fiscal year shall remain the same as those now in effect. It was written into the record that this will provide the companies not more than 3.4 per cent on their investment, which the companies consider confiscatory. It was shown in the hearing that even upon the board's own figures of depreciated valuations the rates are too low to give an adequate return on the investment, but Commissioner Wirsching was determined that there should he no increase in rates. President Wright declared several times during these sessions that a fair rate should be allowed, but he explained that there were only two members of the commission in the city and that the law is imperative, requiring the fixing of rates before the first of May. As his brother commissioner would not agree to any increase, the only alternative was a deadlock or to adopt a resolution fixing the present rates. This will throw the subject before the city council.

WATERWORKS.

PENDLETON, ORE.—The people of Pendleton have voted to bond the city for an additional $40,000 to complete the gravity water system.

PRINEVILLE, ORE.—Henry Cram has been granted a franchise to install a new water system in Prineville. There are 22 springs on the Cram ranch and it is proposed to build a reservoir 200 ft. above the city.

ASHLAND, ORE.—At a recent meeting of the commercial club it was determined to ask the city to vote $175,000 in bonds to be used in piping the water from the mineral springs to the city, placing drinknig pavilions and improving city parks, etc.

BRAWLEY, CAL.—The board of trustees has determined that public interest demands the acquisition and construction of municipal water works. The estimated cost is $35,000. An election will be held in the near future to vote bonds in that amount.

UPLANDS, CAL.—The Citizens Land & Water Company is preparing to expend $10,000 for the improvement of its water service. Plans include a new 800,000 gallon reservoir to be built between Fifteenth and Sixteenth streets, a new 8 inch pipe line to be laid to the city system proper.

MILWAUKEE, ORE.—The council has instructed the city engineer to survey route and ascertain the cost of a pipe line to connect with the Bull Run water system of Portland. The action was taken to ascertain if the $20,000 water bond issue would cover the cost of the pipe line and a municipal plant.

SAN RAFAEL, CAL.—At a meeting of the water directors the Marin Water & Power Company submitted a report of the J. G. White Company as to the physical value of its plant at $2,044,801. This does not include good will, franchises, etc. The financial feasibility committee in its report of the probable cost of land and water plants and Alpine dam system placed it at $3,000,000, divided as follows: Marin Water Company plant, $900,000; North Coast Company, $200,000; Howard Shafter property, $150,000; cost of Alpine dam, $1,300,000; interest on bond during construction, $200,000; additions to system, $200,000.

BUTTE, MONT.—The Butte. Water Company has started work on improvements which will cost approximately $300,000. The plans include a new pipe line from the Basin Creek reservoir to Butte, installation of a big electric pump at the Big Hole civic station and replacement of the 6 inch main on Arizona street with a 10 inch pipe line.

ESCONDIDO, CAL.—Directors of the Escondido Mutual Water Company have passed resolutions declaring intention to carry out plans, by raising the dam and otherwise improving the water system and by developing water power by installing hydroelectric power plants. A bonded indebtedness in the sum of $200,000 will be created to carry out the plans.

FULLERTON, CAL.—Application for permission to construct a reservoir and conduit for conserving the waters of Boulder Creek in San Diego county, for irrigation and power purposes has been made by James A. Murray and Ed Fletcher. The proposed dam will be 40 ft. high, and the conduit 4 miles long. The cost of the plant is estimated at $274,000. The reservoir is designed for a capacity of 2,200,000 cu. ft. of water.

OREGON CITY, ORE.—The committee appointed to netiate with West Linn for the purpose of devising a means of securing a pure water supply recommend that the two cities proceed immediately to obtain water rights and make arrangements for securing the supply. Oregon City is to pay two-thirds of the cost and West Linn one-third, and also that a commission of six members from both cities be authorized to construct the complete system.

OAKLAND, CAL.—The supervisors have taken the legal steps which makes Tuesday, June 2, the date on which the people of the seven east bay municipalities will vote on the question of forming a metropolitan water district. This action makes the option given to the communities interested by F. C. Havens, whereby the Peoples Water Company may be purchased by the district at a price to be named by the state railroad commission a binding one.

RENO, NEV.—The proposition of H. G. Comstock to construct a city water supply which was presented to the council several months ago, came up last week, but no decisive action resulted, the proposal being referred to the committee of the whole for further report. Comstock, in his proposition, agrees to furnish water from a series of wells to be sunk in the vcinity of Laughton's Springs. A complete pumping plant will be installed within a brick, fireproof building and pipe line laid. The plant will have a capacity of supplying a city of 25,000 population. Six different plans were contained in the proposal, and call for a cost of $1,250,000, $775,000, $875,000, $750,000, $825,000 and $850,000, with corresponding rates of interest. Payments are divided in three parts.

ERRATA NEWS NOTE.

The news note on page 371 of the Journal of April 25, 1914, regarding the valuation of the North Yakima gas plant, was in error. The Public Service Commission of Washington has not placed a value on the North Yakima gas plant of the Pacific Power & Light Company, and this report was evidently based upon a report made to the commission hy Chief Engineer F. S. Burroughs, in the course of which he stated that the cost of reproducing the North Yakima plant would be $234,093, the depreciated value being $201,748, and the actual cash invested $198,822.

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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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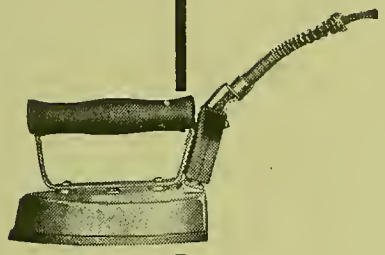
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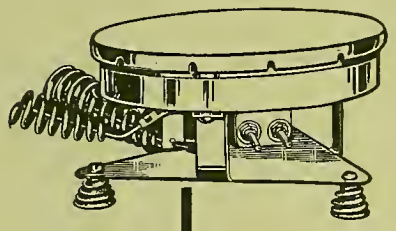
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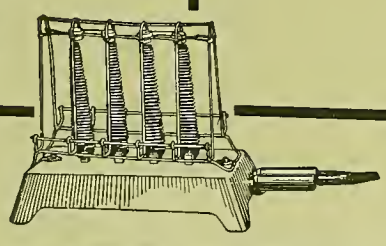
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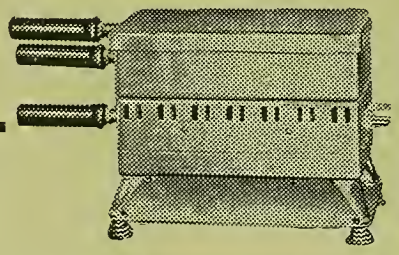
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ELECTRIC DISTRIBUTION

BY RICHARD C. POWELL.

(In this article the author discusses the relative advantages of the different electric distribution systems, refers to their limitations and explains their use. In general, the article states succinctly those distribution requirements which must be considered in the rendering of satisfactory service. The author is superintendent of electrical distribution for the Pacific Gas & Electric Company at Oakland, Cal.—The Editors.)



Main Feeders Leaving the Sub-Station.

The subject of this article, electric distribution, has come to be generally accepted as that branch of electrical engineering which is concerned with the delivery of electrical energy to the consumer from the station or sub-station where it is generated or received from a transmission system.

The writer will not attempt to go very much into details, but will cover in a general way some of the more important features of the subject, and although these are matters of common knowledge to those engaged in distribution work, it is hoped that others in somewhat different lines will also find herein much of interest.

To supply a large community, it is obvious that quite an extensive distribution system is required, the cost of which is apt to exceed that of the generating and transmitting equipment. We, therefore, find in the larger central stations a distribution department devoting itself exclusively to the construction and operation of the distribution system.

The perfection of alternating current distribution has made possible the central station of today, and its peculiar right to permanent existence as a public necessity is maintained by its distribution system, the means of gathering up and concentrating in one generating system all the load of a community. The

economy obtained by generating in large quantities is considerable, but the saving in capital and operating costs resulting from the so-called diversity of load is of great importance; for the capital which has been saved in power generating plants has been diverted to other enterprises, a matter of great economic value. Electrical energy can be transformed into every other form of energy and can be transmitted and distributed more economically. Upon this comparatively simple fact rests the broad foundation of the future central station. We shall expect the central stations eventually to supply all the energy, of whatever form, required within the area covered by its distribution lines.

The work of the distribution engineer is to devise and construct lines to reach all classes of consumers, from the farmer with his intermittent irrigation load to the largest manufacturing establishments. It is evident that in these various classes of service are different requirements to be met, and in a large central station we should expect to find several types or forms of distribution.

In every industry there is an effort to lower the cost of the product, balanced however, by requirements as to quality. With the exception of certain special demands (for example, direct current is more suited to elevator work than alternating current), we



Distribution in a Commercial District.

find the quality of electric distribution to be judged by its voltage regulation and reliability or continuity of supply. The final judge is apt to be the consumer and we, therefore, naturally expect to find any given type of distribution to be somewhat of a balance between cost and what is demanded in the way of regulation and reliability.

The criterion for reliability is the voltage employed and the reliability varies inversely as the voltage, that is, the lower the voltage the greater the reliability. Further, we find in general the greater the density of load the more exacting are the consumers. Hence, we should expect the voltage employed to decrease when passing from a system supplying low load density to one supplying a higher density, and we find this to be the general present day practice. Also certain forms of construction have inherently better



The Leads Are Taken Underground.

qualities than others; for example, overhead distribution does not equal underground for reliability, and three-phase star circuits have better regulation than those delta connected.

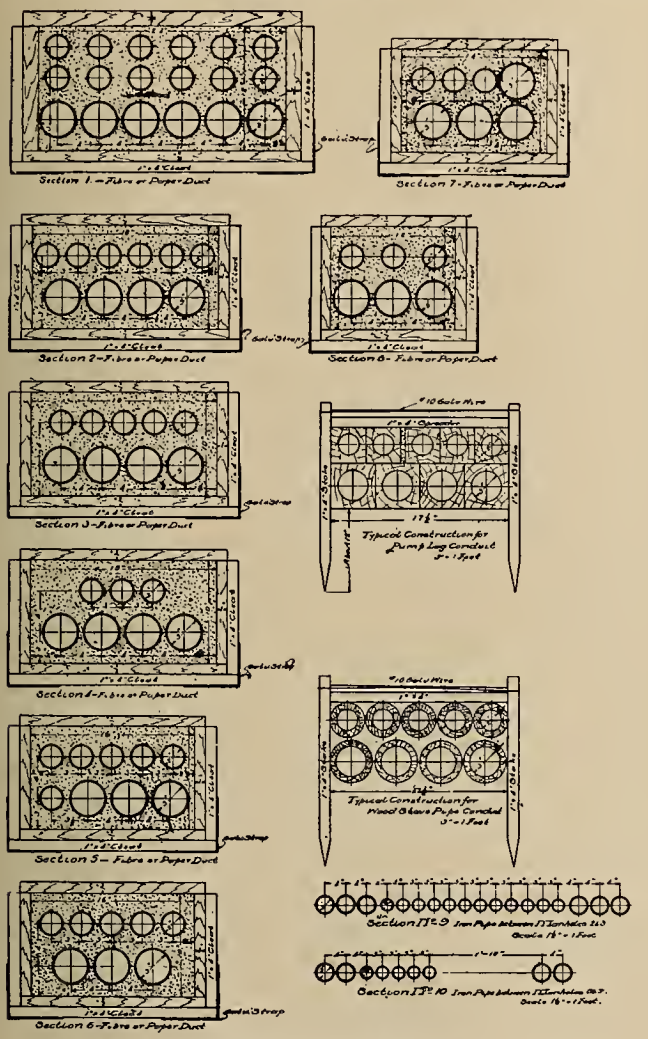
Consumers may be divided into four general classes, viz: rural, residential, commercial, and in the larger cities industrial.

The rural load is characterized by low annual load factor (sometimes not over 5 per cent) scattered over a large area with considerable distances between consumers. It is a power load and requires a low rate, which, together with the extremely poor load density, requires the cheapest form of construction compatible with safety and satisfactory operating of induction motors. In order to keep down the investment in copper (which is almost always bare) a voltage from 10,000 to 15,000 is used and in some cases 20,000 or over; short poles, (often 30 ft.) and long spans (200 ft. to 300 ft.) being the rule; sometimes iron wire is strung and in some cases ground return for single-phase has been employed. The use of ground in place of a conductor, however, is questionable practice and almost certain to prevent satisfactory operation of neighboring telephone lines.

On account of the length of circuits, the exposure to trouble is considerable and switches (air break) should be inserted at intervals to assist in clearing trouble and for convenience when working on the line. On branch lines supplying a single bank of transformers, the fuses would preferably be installed where the main line is tapped, rather than at the transformers.

When built with regard to mechanical details, and with insulators ample for the voltage employed, these higher voltage lines have proved very satisfactory for rural load.

The residential load varies from the small scattered loads in new real estate tracts to the comparatvely high density in the older and more solidly built



Sections Through Conduit Systems Used for Temporary Construction.

up sections which in addition to dwellings contain small business centers, apartment houses and small factories. Hence, certain circuits supplying a residential territory will have a considerable apartment house and commercial (small stores) load and also a fair day load from the small factories. The load factor for residential circuits will vary from 10 or 15 per cent for those supplying the more remote districts to 30 per cent for those feeding territory adjacent to the business section. The density of load in kw. per sq. mile of maximum feeder demand varies from 100 or 200 to 750 or possibly 1000 in the largest cities on the Pacific Coast.

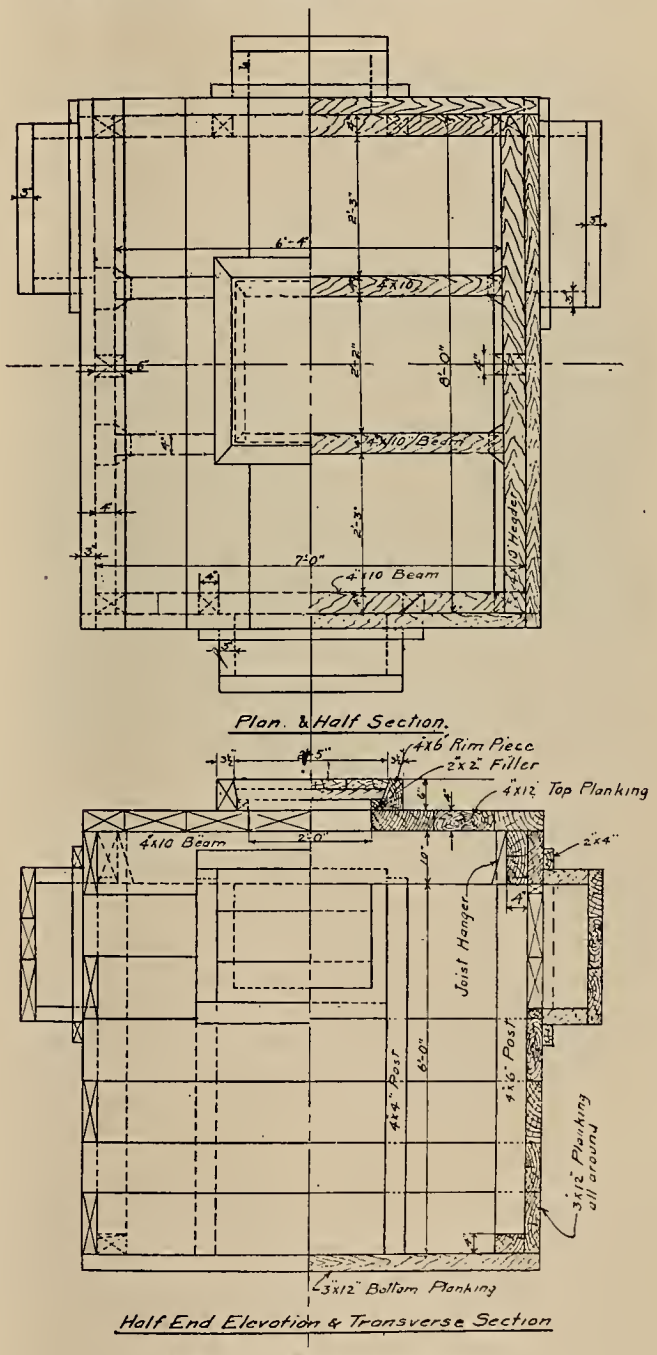
It is advisable to use the same type of construction in the new real estate tracts as in the older portion of a city since, for most cities on the Pacific Coast, the new sections build up with remarkable rapidity.

For the residential load we must be prepared to furnish good service for we shall find many exacting consumers. We shall also find it profitable to encourage, as far as possible, an increased use of electricity in the residential sections, and it is evident we cannot expect to do this with poor service. Consumers must not be subjected to frequent or prolonged unsteadiness of voltage, or to voltage so low or so high that the life of lamps or quality of light is impaired. Finally, interruptions must not be frequent or protracted.

For this class of service the following general types are in more or less common use.

2 wire 2400 volt single-phase primaries with three-phase circuits for power.

3 wire 2400 volt, three-phase delta.
4 wire 4100 volt, three-phase star.
3 wire 6600 volt, three-phase delta.
4 wire 11000 volt, three-phase star.
3 wire 11000 volt, three-phase delta.
4 wire 2400 volt, two-phase.



A Manhole Made of Planking.

The secondaries for the three-phase systems are sometimes three-phase also, but the usual practice is to run a three-phase feeder to supply single-phase primary mains with single-phase three-wire second-

aries, stringing three-phase mains for power only. Where three-phase secondaries are the rule they may be either delta or star, preferably the latter, with 120 volts to neutral and 208 volts between wires. The disadvantages of continuing poly-phase distribution beyond the feeder are higher transformer costs and difficulty in maintaining the loads balanced; and unless the loads are kept balanced, the balancing currents will destroy any economy in transmission which three-phase has over single-phase. The small motors generally installed in residential districts are better taken care of by single-phase, extending three-phase for large installations only. Many central stations require a.c. motors of 3 h.p. or less, to be single-phase, and some raise the limit to 5 h.p.

Some of the advantages and disadvantages of the systems given above will be taken up.

The 2 wire, 2400 volt system has great reliability since the load per feeder is usually not more than 200 or 300 kw. and hence trouble on one feeder effects a comparatively limited number of consumers. The disadvantages are rather low voltage for economy, particularly for larger cities, and inability to combine power and lighting load, thereby loosing in so far as capacity is concerned, the gain due to great diversity of light and power load. With the present automatic feeder regulators it is no longer necessary to run separate circuits for power.

For the most part 2400 volt feeders are no more reliable than 4100 volt, 4 wire feeders with grounded neutral, since the same transformers are used and insulation strain on the line is the same to ground. The disadvantage in using 4100 volts may be in the temptation to get on too much load per feeder, thereby interrupting too many consumers when trouble appears on either the feeder or the mains which is supplies.

With a single-phase regulator in each phase of a 4 wire feeder (either three-phase or two-phase) each phase may be regulated independently of the others for in practice the load can be quite evenly divided among the phases and therefore, the neutral drop is negligible. Since in delta circuits the loads are interconnected to the three phases, the regulation is not so good as in star, and for this reason the 4 wire star is preferable to the 3 wire delta.

Six thousand six hundred and 11,000 volt lines are much more liable to insulation breakdowns with consequent interruptions than 4100 volt lines. Transformers for 6600 and 11,000 volt service are more expensive, less free from breakdowns, and have poorer regulation than the 2400 volt type. The one advantage of the higher voltage lines for distribution work is the saving in copper, but this is apt to be of doubtful value particularly to any central station maintaining substations for supplying railway direct current. Such a central station can cover the distances between substations very nearly as economically with 4100 volts as with 11,000 volts and can certainly maintain much better service.

With 11,000 volts for city distribution the tendency is to cover too much territory, thus not only increasing the exposure to trouble but interrupting too much load on a feeder shut down. In addition to the above objections to 11,000 volts for this class of service, such lines cannot be worked upon alive and it is therefore, necessary to interrupt a portion of the load, at least, in order to cut in a transformer or otherwise work on the line; 4100 volt feeders limited to 300 kw. capacity for low density to 700 kw. maximum capacity are giving excellent service, particularly when oil switches are installed for separating or tying to primary mains supplied from adjacent feeder, or feeders.

The 4 wire two-phase system is inferior in economy to 4 wire, three-phase and is to be found principally in the older systems started before three-phase had become established.

The commercial load is that of a strictly business section made up of office buildings, department and other stores, hotels, etc. In the smaller cities this load is well taken care of by the same type of alternating current system, as for the residential load in larger cities. As the city grows, not only in size but in height and splendor, demands for improved appearance of streets and greater reliability of service require some form of underground construction. The standard form for this is the so-called "draw in" type, in which lead covered cables are pulled between manholes through clay, fibre or concrete ducts. The usual procedure at this stage of the city's development is to simply replace overhead construction by underground, preserving the same type of system, that is, overhead primaries and secondaries will be replaced by lead covered cable connecting by risers to overhead wires at the boundary of the underground district. The secondaries will be supplied by subway transformers placed in manholes. About this time, if not before, direct current will be required for operating elevators. In cities having a 500 volt d.c. street railway system, a commercial power feeder supplied by the railway generators is the usual practice. Most of the Pacific Coast cities have a 500 volt d.c. power system, a survival of the early practice of connecting power loads to the nearest trolley. As the load increases, and the underground district is extended, the alternating current feeders are placed entirely underground to the station and the 500 volt d.c. feeders are supplied by generators not operated in parallel with railway generators, that is, the commercial feeders are operated as a system independent of the railway.

The proceeding is descriptive of cities growing up at the present time or in the larger cities in which electric plants were installed subsequent to the development of alternating current distribution. In the older cities Edison d.c. 3 wire, 220-110 volt systems were first used, and these have been extended so that we find most of the older cities on the Pacific Coast operating 220 volt, 3 wire d.c. systems to supply the dense commercial loads. In the early days, the loads were small with correspondingly small conductors, so that the starting of elevators or other comparatively large motors was apt to considerably disturb the lighting service. For this reason 500 volt d.c. from the railway system was distributed for the power loads. However, as the 220 volt system grew, it was able to absorb the power incident to a business district without detriment to the lighting service.

Hence, in the older and larger cities, we find practically all the commercial load on the 220 volt d.c. system, the 500 volt d.c. being maintained to handle the load not convenient, or economical to change to 220 volts.

The Edison 3 wire system was about the earliest type of electric distribution, and at the present time is still maintained in our largest cities. It is therefore, being depended upon to take care of the densest loads and where extreme reliability is demanded by those consumers to whom any interruption of service whatever is intolerable and might lead to the installation of an isolated plant. This system probably owes its continuation and extension, more to general excellence than to any fact of priority. Today it is essentially the same as when first installed by Edison, and remains the system par-excellence for dense commercial loads which in some of the very large cities exceeds 7500 kw. per sq. mile.

Low voltage (not over 250 volts) d.c., underground systems, will probably be, for many years to come if not for all time, the most reliable means of distributing electricity, though its cost will limit its use to heavy commercial service. The voltage employed is so low that the question of insulation is a simple one, and in many cases only a slight mechanical separation is sufficient.

Direct current has a marked advantage over alternating, for extensive network distribution. It would be a very difficult matter to so adjust and maintain the capacity and reactance in a network, so that, so-called "circulating currents" would not flow, with attendant loss in efficiency and voltage regulation. With direct current the currents dividing inversely as the resistances of the various branches of the network, in a certain measure force the cables automatically to divide load in proportion to their capacities.

The branches of the network are connected together through copper link fuses. The feeders are connected to the station bus through switches and to the mains with fuses. Thus trouble in any branch is automatically cleared by the blowing of its fuses and without disturbance to the system as a whole. No more expensive and dependable devise than the short link copper fuse can be imagined, but unfortunately its use is limited to low voltages.

Finally, by connecting standby storage batteries to the 220 volt, 3 wire, d.c. system, uninterrupted service is insured against station shut downs, or accidents imparing station capacity.

The feeders are usually not larger than 1,000,000 c.m. and carry maximum loads of approximately 200 kw.

It is customary in d.c. practice to connect wires to the network at various points and run them back to the station and arranged for connection to a voltmeter or voltmeters. The station operator is then in a position to know if the proper voltage is being delivered.

When load is thrown on a direct current network, each branch or element takes up some portion of that load, so that in practice it is rare to meet with suddenly applied loads of sufficient magnitude to disturb the system in any way. For this reason automatic regulation is not necessary.

Smaller systems have the feeders connected to a single bus, the bus voltage being raised as the load comes on. The larger systems have from 2 to 5 buses maintained at different voltages over the peak. The voltage of the highest bus will be that sufficient to give correct voltage at the end of the longest, or heaviest loaded feeders; the lowest bus will be held at sufficient voltage to give proper service on the shortest, or lightest loaded feeder, while the other buses will be at various intermediate voltages.

As the load comes on, those feeders supplying a vicinity showing dropping voltage by the pressure wire volt meters are transferred to a higher voltage bus.

In the average city the industrial load is so intermingled with the residential and connected to these circuits that it is not taken care of separately. However, at times very large shops and factories having loads of several thousand kw. are supplied with central station power. These large loads are rather to be considered as substations, and are undoubtedly better handled as such. The standard voltage between stations and substations should be employed to avoid station or substation transformation losses. Usually the consumer will demand a duplicate line or standby service of some sort to insure him against shut down.



In Some Residential Districts Underground Distribution Is Essential.

A new method of destroying teredos, a borer pest which has caused enormous damage in the destruction of piles used in wharfage construction in North Pacific Coast ports, particularly in Vancouver, Seattle and Tacoma, by turning an electric current into the piles, is being tried in Seattle. These pests have so far successfully defied all attempts to eradicate them from the timbers supporting the various structures along the water front in the Puget Sound and British Columbia ports, and a means of destroying them will prove a great saving to individuals and companies maintaining docks and wharfage properties on the coast.

SUPREME COURT DECISION REGARDING CAPITALIZATION OF WATER RIGHTS.

THE SAN JOAQUIN AND KINGS RIVER CANAL & IRRIGATION COMPANY, INCORPORATED.

Appellant.

vs.

THE COUNTY OF STANISLAUS, IN THE STATE OF CALIFORNIA, *et al.*

Appeal from the Circuit Court of the United States for the Northern District of California.

(April 27, 1914.)

Mr. Justice Holmes delivered the opinion of the court.

This is a bill to restrain the enforcement of orders, passed by the boards of supervisors of the three defendant counties, Stanislaus, Fresno and Merced, establishing water rates to be charged by the plaintiff, the appellant; the ground of the bill being that the orders deprive the plaintiff of its property without due process of law. By a statute of March 12, 1885, the boards are authorized to fix these rates for their several counties, but so that the returns to the parties furnishing the water shall not be less than 6 per cent upon the value of the "canals, ditches, flumes, chutes, and all other property actually used and useful to the appropriation and furnishing of such water." The rates when fixed are binding for one year and until established anew or abrogated. The bill concerns rates fixed in 1907, and the question before the court has been narrowed to a single issue. If the plaintiff is entitled to 6 per cent upon its tangible property alone it is agreed that the orders must stand. But if the plaintiff has water rights that are to be taken into account, the rates fixed will fall short of giving it what it is entitled to and must be set aside. The Circuit Court dismissed the bill, 191 Fed. Rep. 875, and on this appeal figures are immaterial, the only question being whether the principle adopted is right.

It was suggested to be sure at the argument that it does not appear that the plaintiff offered any evidence as to water rights at the hearing before the supervisors, and therefore that it ought not to be allowed to complain now that nothing was allowed for them. But this evidently is an afterthought. In general, a party may wait until a law is passed or regulation is made and then insist upon his Constitutional rights. Prentis v. Atlantic Coast Line Co., 211 U. S. 210, 227, 229. This we understand to be the view of the California courts as to these very boards. Spring Valley Water Works v. San Francisco, 82 Cal. 286, 315. San Diego Water Co. v. San Diego, 118 Cal. 558, 564. Moreover as the defendants contend that the plaintiff is entitled to no compensation for water rights, to offer evidence would have been an idle form.

It is not disputed that the plaintiff has a right as against riparian proprietors to withdraw the water that it distributes through its canals. Whether the right was paid for, as the plaintiff says, or not, it has been confirmed by prescription and is now beyond attack. It is not disputed either that if the plaintiff were the owner of riparian lands to which its water was distributed it would have a property in the water that could not be taken without compensation. But it is said that as the plaintiff appropriates this water to distribution and sale it thereby dedicates it to public use under California law and so loses its private right in the same. It appears to us that when the cases cited for this proposition are pressed to the conclusion reached in the present case they are misapplied. No doubt it is true that such an appropriation and use of the water entitles those within reach of it to demand the use of a reasonable share on payment. It well may be true that if the waters were taken for a superior use by eminent domain those whose lands were irrigated would be compensated for the loss. But even if the rate paid is not to be determined as upon a purchase of water from the plaintiff, still, at the lowest, the plaintiff has the sole right to furnish this water, the owner of the irrigated lands can not get it except through the plaintiff's help, and it would be unjust not to take that fact into account in fixing the rates. We are not called upon to decide what the rate shall be, or even the principle by which it shall be measured. But it is proper to add a few words.

The declaration in the Constitution of 1879 that water appropriated for sale is appropriated to a public use must be taken according to its subject matter. The use is not by the public at large, like that of the ocean for sailing, but by certain individuals for their private benefit respectively. Thayer v. California Development Co., 164 Cal. 117, 128. Fallbrook Irrigation District v. Bradley, 164 U. S. 112, 161. The declaration therefore does not necessarily mean more than that the few within reach of the supply may demand it for a reasonable price. The roadbed of a railroad is devoted to a public use in a stricter sense, yet the title of the railroad remains, and the use though it may be demanded, must be paid for. In this case it is said that a part of the water was appropriated before the Constitution went into effect, and that a suit now is pending to condemn more as against a riparian proprietor, for which of course the plaintiff must pay. It seems unreasonable to suppose that the Constitution meant that if a party instead of using the water on his own land, as he may, sees fit to distribute it to others he loses the rights that he has bought or lawfully acquired. Recurring to the fact that in every instance only a few specified individuals get the right to a supply, and that it clearly appears from the latest statement of the Supreme Court of California, Palmer v. Railroad Commission, January 20, 1914, that the water when appropriated is private property, it is unreasonable to suppose that the constitutional declaration meant to compel a gift from the former owner to the users and that in dealing with water "appropriated for sale" it meant that there should be nothing to sell. See San Diego Water Co. v. San Diego, 118 Cal. 556, 567. Fresno Canal & Irrigation Co. v. Park, 129 Cal. 437, 443, et seq. Stanislaus Water Company v. Bachman, 152 Cal. 716. Leavitt v. Lassen Irrigation Co., 157 Cal. 82.

Decree Reversed.

Gas has influenced London fog conditions, said Prof. V. B. Lewes, in his lecture on "The Hygienic Value of Coal Gas as an Illuminant and a Fuel," given at the recent Manchester (England) Gas Conference. The wide introduction of the gas stove in London is responsible for this. One-sixth of the chimneys, he stated, have ceased to add their quota of smoke to the atmosphere, and the registers show more hours of sunlight, while the cleansing of the fog is a still more marked result.

COST OF FINANCING UTILITIES.

(This article on the high cost of obtaining money for extensions and improvements to California public utilities is abstracted from an affidavit filed in the U. S. District Court by A. F. Hockenbeamer vice-president and treasurer of the Pacific Gas & Electric Company, in a rate suit instituted by his company against the city and county of San Francisco.—The Editors.)

Compelled Utility Expenditures.

Gas and electric companies are compelled, under the laws of the State of California, to render satisfactory and adequate service, and to extend their facilities to all residents within the territory served who may be located within 100 ft. of mains or distribution lines. Refusal or neglect to supply gas or electricity within ten days after application makes them liable for the payment to the applicant of $50 as liquidated damages, and of $5 per day as liquidated damages for every day such refusal or neglect continues thereafter.

The municipalities of the state possess and frequently exercise, the power of compelling gas and electric companies to incur other large expenditures in placing their distribution facilities under ground and in accommodating existing facilities to changes in street lines, changes in or the construction of new sewers, water pipes and other civic improvements.

Within the last two years the Constitution of the state has conferred upon the Railroad Commission of California broad powers for compelling extensions and betterments of facilities, and of enforcing higher standards of service and safety.

The investment of vast sums is not a matter of choice. The utility cannot choose to stand still and escape the law's penalties by pleading lack of funds, but must take its securities into the money markets of the world, when and as necessary, and secure at whatever cost is necessary, the large amounts of new capital required by it.

Capital Required for Obligations Maturing.

In addition to the large sums of money required for betterment and extension, large amounts of new capital must be raised for the purpose of paying maturing obligations.

Owing to the inability of companies to realize from the sale of authorized bonds the par value thereof, they are compelled, from year to year, to find large sums of money, other than from the proceeds of the sale of its bonds, to pay for the difference between the actual cost of new construction and the amount realized or to be realized from the sale of bonds. The railroad commission will not permit the money necessary for meeting this so-called "bond account" to be raised through the sale of securities, and it must, therefore, be taken from the earnings of the companies. While this so-called "bond discount," as a matter of accounting, is amortized over the life of the bonds, it is, nevertheless, an obligation which must be met in cash at the time the construction work is done.

Bond quotations in the securities market afford no indication whatever of the rate of return upon the fair value of the properties that will permit companies to secure the large amounts of new capital required from time to time to carry on their enterprise and to fulfill the obligations imposed with respect to giving service to the inhabitants of the territory served and to yield to the owners of the utility an adequate return commensurate with the hazards attendant upon the inauguration and conduct of the enterprise.

Status of Gas and Electric Investments.

Investors will purchase the bonds of municipalities, at prices which yield to them a less return than they are willing to accept upon investments in the bonds of gas and electric companies. They will also purchase the bonds of well established steam railroads, at prices that will yield to them a less return than they are willing to accept upon investments in the bonds of gas and electric companies, for the reasons, among others, that the business of steam railways has been established upon an investment basis many years longer than the business of gas and electric companies; that the steam railroad business is less subject to destructive competition, and that the securities of steam railroad companies, under the laws of divers states, have been legalized for the investment of trust funds, savings banks, and other investment institutions which are not permitted under such laws to purchase the bonds of gas and electric companies.

There is a vital distinction between so-called "closed issues" and "open issues" of bonds of public utility corporations. The term "closed issue" means that no more bonds may be issued under the terms of the indenture securing such bonds. It follows that when the supply ceases the continued demand usually raises the level of prices of such bonds. The closing of a bond issue also results almost invariably in increasing the safety of such bond issue by reason of the fact that the value of the property to secure it is increased through the application of funds derived from the sale of stocks or bonds which are junior to the closed issue. There is no escape from the creation of such a condition when the utility operates in a growing territory and is alive to the obligations imposed upon it to serve the public. In addition to the larger equity thus created for the holders of the "closed issue," the purchaser of such underlying closed issue also has the assurance that the obligation held by him must be protected by the owners of the junior obligations. As a means of raising new capital closed issues are of no benefit to the utility and the citation, therefore, of the market prices of closed bond issues, as indicative of the cost of money to utilities or as evidence that money in large amounts can be secured on approximately the terms indicated by the market quotations of closed bond issues, is illogical and without support in fact.

The Cost of Capital.

Market quotations of bonds based on transactions between investors do not correctly indicate the cost to the utility of new capital required in the growth and development of its enterprise. It is not practicable for it to obtain this new capital through the sale of securities in small amounts directly to investors. Before proceeding with the execution of larger plans of development, assurance must be given in advance that the money required will be available when needed. Companies must, therefore, dispose of bonds at wholesale to investment bankers having at their disposal the necessary capital or banking credit to pay for the bonds in cash when delivered.

The cost to gas and electric companies of authorizing, issuing and marketing their bonds in the usual and customary manner, including the compensation of trustees under the mortgages, fees of counsel, commissions paid to bankers, and official fees required by the Public Utilities Act to be paid to the Railroad Commission of California will rarely, if ever, be less than five, and frequently amounts to ten per cent or more of the par value of the bonds.

A distinction must be made between the stockholders of a public utility and its bondholders and between two things that are fundamentally different, namely:

(a) What is a reasonable and fair rate upon investments made by a corporation in acquiring or directing or operating its properties for public purposes, and

(b) The rate of interest at which a public utility corporation can borrow a limited portion of the capital necessary in the conduct of its enterprise.

The borrowing of money by a utility, whether it be through the sale of bonds or otherwise, is merely an incident of management and the rate at which it is able to borrow money is not a fair measure of the compensation that should be allowed to the owners of the utility to compensate them for the risks of the business and for the liability which they assume in protecting the creditors from whom the money is borrowed.

Stockholders and Bondholders Differentiated.

There is a fundamental difference between the stockholders of a public utility and its bondholders; that the former are partners in the enterprise while the latter are merely creditors; the former assume all the risks of the business while the latter merely loan money secured by the stockholders' property. The rate of return which would be attractive to a bondholder, who is a creditor entitled to repayment of a definite sum of money at a definite time with interest thereon, secured as to repayment of the principal of his obligations by the pledge of specific property and further protected by the liability of the stockholders for the debts of the utility, is not the rate of return which would tempt investors to engage as owners in any line of business, public utility or otherwise, assuming as they necessarily would, not only the hazards attendant upon the inauguration and conduct of the enterprise but an absolute obligation to pay the debts of the corporation. If to the owners of the enterprise there is not accorded a larger return than to its creditors capital cannot be found in large volume to undertake the burden of public utility financing, construction and operation.

The Tabulated Bond Issues.

The accompanying table shows issues of bonds of gas and electric companies operating within California, which the railroad commission has authorized since the public utilities act became effective on March

BOND ISSUES OF CALIFORNIA GAS AND ELECTRIC COMPANIES.

Name of Issuing Utility.	Description of Bonds.	Unexpired Life of Bonds.	Total Par Value Authorized by Commission.	Date Authorized by Commission.	Sale Price Authorized by Commission.	Approximate Yield Per Annum to Investors if Held to Maturity.
Holton Power Co.	First and Refunding 6%..	39 Years	$ 300,000	July 3, 1912	.80	7.9 %
Indian Valley Elec. L. & Power Co.	First 6%	40 Years	81,535	Aug. 23, 1912	.80	7.9 %
Mt. Whitney Power & Electric Co.	First Mortgage 6%	27 Years	250,000	Nov. 18, 1912	.95	6.39%
Northern California Power Co. Con.	Debenture Notes 6%	5 Years	500,000	Aug. 14, 1912	.96	6.96%
Pacific Gas & Electric Co.	General and Refunding 5%	29 Years	5,000,000	Sept. 14, 1912	.85	6.09%
San Diego Cons. Gas & Electric Co.	First Mortgage 5%	27 Years	250,000	Sept. 4, 1912	.94	5.43%
San Joaquin Light & Power Corp.	First and Refunding 5%..	38 Years	925,000	Nov. 26, 1912	.87	5.80%
Santa Barbara Gas & Electric Co.	First Mortgage 6%	29 Years	5,000	Sept. 7, 1912	.95	6.38%
Santa Maria Gas & Power Co.	6%	15 Years	50,000	July 30, 1912	1.00	6. %
Southern California Utilities Co.	6%	30 Years	10,000,000	Nov. 13, 1912	.9675	6.24%
Southern Counties Gas Co.	First Mortgage 6%	29 Years	47,000	Oct. 14, 1912	.85	7.23%
West Coast Gas Co.	6%	40 Years	100,000	Nov. 5, 1912	.80	7.9 %
Western States Gas & Electric Co.	First and Refunding 5%..	28 Years	351,000	June 7, 1912	.875	5.92%
Western States Gas & Electric Co.	First and Refunding 5%..	28 Years	600,000	Sept. 20, 1912	.875	5.92%
West Coast Gas Co.	First Mortgage 6%	40 Years	250,000	Nov. 5, 1912	.80	7.9 %
Indian Valley Elec. L. & Power Co.	Notes 7%	.....	.....	Aug. 25, 1912	1.00	7. %
Imperial Valley Gas Co.	First Mortgage 6%	17 Years	154,600	Jan. 8, 1913	.80	8.12%
Western States Gas & Electric Co.	First and Refunding 5%...	28 Years	397,000	Jan. 10, 1913	.885	5.84%
Southern California Edison Co.	General Mortgage 5%	27 Years	2,500,000	Jan. 27, 1913	.92	5.58%
San Diego Cons. Gas & Electric Co.	First Mortgage 5%	26 Years	204,000	Feb. 11, 1913	.95	5.34%
City Electric Co.	First Mortgage 5%	25 Years	833,000	Feb. 24, 1913	.84	6.25%
Southern Counties Gas Co.	First Mortgage 6%	28 Years	5,500	Mar. 1, 1913	.85	7.2 %
Great Western Power Co.	First Mortgage 5%	33 Years	4,411,000	Mar. 11, 1913	.90	5.56%
Los Angeles Gas & Electric Corp.	First and Refunding 5%..	26 Years	900,000	Apr. 10, 1913	.945	5.38%
Sacramento Natural Gas Co.	First Mortgage 6%	28 Years	193,000	Apr. 24, 1913	.95	6.39%
Mt. Whitney Power & Electric Co.	First Mortgage 6%	26 Years	250,000	Apr. 25, 1913	.95	6.40%
Southern Counties Gas Co.	First Mortgage 6%	28 Years	8,000	May 3, 1913	.85	7.2 %
Pacific Gas & Electric Co.	Debenture 6%	10 Years	5,000,000	May 15, 1913	.95	6.69%
Southern Counties Gas Co.	First Mortgage 6%	28 Years	4,000	June 11, 1913	.85	7.2 %
San Diego Cons. Gas & Electric Co.	First Mortgage 5%	26 Years	180,000	June 30, 1913	.85	6.21%
Beaumont Gas & Power Co.	Notes 8%	5 Years	5,000	July 2, 1913	1.00	8. %
Economic Gas Co.	First Mortgage 5%	28 Years	270,000	July 10, 1913	.83 1/3	6.35%
Santa Barbara Gas & Electric Co.	First Mortgage 6%	28 Years	100,000	July 10, 1913	.95	6.39%
California Telephone & Light Co.	First Mortgage 6%	30 Years	350,000	June 17, 1913	.94	6.42%
San Joaquin Light & Power Corp.	First and Refunding 5%..	37 Years	1,776,000	July 12, 1913	.80	6.50%
Southern Counties Gas Co.	First Mortgage 6%	28 Years	75,000	Aug. 6, 1913	.85	7.2 %
Western States Gas & Electric Co.	First and Refunding 5%..	27 Years	354,000	Aug. 30, 1913	.885	5.83%
Western States Gas & Electric Co.	First and Refunding 5%..	27 Years	75,000	Oct. 2, 1913	.825	6.35%
Midland Counties Public Serv. Corp.	First Mortgage 6%	40 Years	1,559,000	Oct. 1, 1913	.92	6.55%
Pacific Gas & Electric Co.	Gold Notes 6%	1 Year	7,000,000	Sept. 24, 1913	.955	10.75%
Sonoma Valley Light & Power Co.	First Mortgage 6%	30 Years	30,000	Sept. 30, 1913	.825	7.4 %
Amador Light & Power Co.	First Mortgage 6%	16 Years	12,000	Oct. 2, 1913	1.00	6. %
Hemet-San Jacinto Gas Co.	First Mortgage 6%	13 Years	3,000	Oct. 8, 1913	.825	7.1 %
Napa Valley Electric Co.	First Mortgage 6%	17 Years	20,500	Oct. 14, 1913	1.00	6. %
San Diego Cons. Gas & Electric Co.	First Mortgage 5%	26 Years	27,000	Oct. 29, 1913	.85	6.21%
Coast Valleys Gas & Electric Co.	First Mortgage 6%	38 Years	114,000	Oct. 30, 1913	.90	6.75%
San Diego Cons. Gas & Electric Co.	First Mortgage 5%	26 Years	41,000	Nov. 14, 1913	.85	6.21%
California Telephone & Light Co.	First Mortgage 6%	30 Years	100,000	Nov. 21, 1913	.94	6.46%
Mt. Whitney Power & Electric Co.	First Mortgage 6%	26 Years	250,000	Dec. 5, 1913	.95	6.40%
Coachella Valley Ice & Electric Co.	6%	31 Years	300,000	Dec. 13, 1913	.80	7.6 %

23, 1912, down to approximately the present time. This shows the names of the issuing utilities, the title of each bond issue and the annual rate of interest paid thereon, the approximate unexpired life of each bond issue, the total par value of each of the bond issues so authorized by the commission, the date of the commission's authorization, the minimum sale price authorized by the commission and Mr. Hockenbeamer's calculation of the approximate yield per annum to the purchasers of each bond issue so authorized if held to the maturity thereof.

This is indicative of the prices at which the gas and electric companies of California are able, or hope to be able, to borrow money on the security of their property. The calculated rates of return to the purchasers of these bonds do not indicate the rates of return that must be allowed to utilities to enable them to earn the interest rates shown and a sufficient margin of profit over and above such interest rates to establish their credit and consequent ability to dispose of these securities. These calculated rates of return do not indicate the rates of return that must be allowed to these utilities to enable them to meet other necessary demands and charges against their net profits in addition to bond interest; nor do they include any of the necessary expenses incident to the issuance and sale of these securities, and do not indicate the rate of return that should properly be allowed to the owners of these utilities, as distinguished from its creditors, to compensate them for the obligation to repay to the creditors the money borrowed through the sale of these bonds and to compensate them for all of the other risks and hazards incident to the ownership and management of their enterprises.

This list embraces fifty issues authorized by the railroad commission during the first twenty-one months of its existence, a period of varying degrees of stress and ease in the money market. The prices at which these issues were authorized to be sold by the railroad commission represent the experience and best opinion of the responsible executives of twenty-nine well established public service corporations of the state of California. These prices were authorized by the Railroad Commission of California, after full hearing on each application, and may be assumed to represent its best judgment and opinion also. The fifty bond issues have a total par value of $48,086,-035; of this total $10,892,000, or 23 per cent, representing the very best of these issues, unusually well secured and having exceptionally large margins of earnings, were authorized to be sold at prices netting the purchasers from 5.34 per cent to 5.92 per cent per annum; $26,955,500, or 56 per cent, were authorized to be sold to net the purchasers from 6 per cent to 6.96 per cent per annum and $10,238,535, or 21 per cent, were authorized to be sold to net the purchasers from 7 per cent to 10.75 per cent per annum. These are the bare interest rates on secured obligations and do not include any percentage of profit in excess thereof which must be earned to make the bonds salable and do not allow for any compensation whatsoever to the stockholders who assume all the risks of operating these utilities and, under the California law, must guarantee the payment of the principal and interest of these secured obligations.

Necessity for Other Than Borrowed Capital.

Public utilities generally cannot conduct their enterprises entirely on borrowed capital, that is, on money raised through the sale of bonds. Money obtained through the issuance and sale of bonds secured by mortgage is the cheapest form of capital obtainable by utilities, as it involves the minimum of risk to the investor. The investor, however, naturally insists that the property pledged for his security shall exceed in value the face amount of the bonds issued against such security. This is not only a well recognized and generally observed principle in corporate financing but is a principle of ordinary business prudence which other lenders of money adopt in safeguarding their principal and which is also recognized by the laws of the state of California which prohibit savings banks from loaning money on real estate in excess of 60 per cent of its market value. In recognition of this principle it is customary to insert in mortgages securing issues of public utility bonds covenants limiting the par value of bonds that may be issued for purposes of aiding the utility in the payment of the cost of additions, betterments and improvements to amounts substantially less than the actual cost of such additions, betterments and improvements.

The railroad commission has not only repeatedly endorsed the principle and expressed the opinion that the utilities of California should not obtain all their capital from borrowed money, but has stated that not more than 75 per cent of the capital of the utilities of this state ought to be obtained by borrowing it. It follows that, irrespective of the conditions imposed under the terms of public utility mortgages, the utilities of this state must reckon on obtaining a substantial proportion of their new capital either from their earnings or from the sale of stock or other unsecured obligations which do not guarantee a fixed and certain return to the investor and must, therefore, be sold upon terms which compel the utility to pay a substantially higher rate than money may be obtained for through the sale of secured bonds.

Earnings and the Sale of Stock.

Notwithstanding the higher rate of return to the investor which an electric company may be willing to pay, or may be compelled to pay, for the purpose of raising capital through the issuance and sale of stock, this means of raising capital funds is practicable only in the event that it is able to earn and that it be permitted to earn, sufficient net profits from its operations to pay its bond interest, a reasonable dividend upon its stocks and a sufficient margin over and above such interest and dividend requirements as will create in the mind of the investor a confidence that the return upon his investment is reasonably well secured and is sufficient to compensate him for the risk he takes in putting his money into unsecured obligations with no definite fixed or obligatory rate of return and of assuming the responsibility for his proportionate share of such indebtedness as the company may incur during the period that he is a stockholder.

The rate of return to the purchasers of stocks does not indicate the rate of return that must be

allowed to utilities to enable them to earn the dividend rates shown and a sufficient margin of profit over and above such dividend rates to establish their credit and consequent ability to dispose of these securities. These dividend rates do not indicate the rate of return that must be allowed to these utilities to enable them to meet other necessary demands and charges against their net profits in addition to interest and dividends. These dividend rates do not include any of the necessary expenses incident to the issuance and sale of these securities.

Importance of an Established Confidence.

The ability of a well established utility to raise new capital for extensions, additions, improvements and betterments through the sale of its securities, and the prices which it may obtain for such securities depends entirely upon a confidence in the minds of the investors of certainty of return on such securities. This confidence in the certainty of return depends upon the net profits which the enterprise may be able or which it may be allowed to earn. If a public utility is unable to show a rate of growth in its net profits commensurate with the additional capital invested in its properties from year to year, or if its net profits decline or remain stationary, its ability to raise new capital becomes impaired, and if the necessary capital can be secured at all, it is only through the payment of very high rates of interest. If a public utility is able to show net profits, or is permitted to earn net profits, which are barely sufficient to pay bond interest its bonds thereupon become speculative securities and if they can be sold at all by the utility, can be sold only at a great sacrifice in price and the payment of a correspondingly high rate for the new capital. The ability of an established utility to market its securities at all, or to market them upon reasonable terms, depends largely upon the net profits remaining after providing for the payment of the interest or dividends upon such securities and this margin of safety determines in the minds of investors whether any given security affords a safe medium for the investment of their funds. The foregoing principles are so well recognized by both investors and bankers that it has become to be recognized as sound practice to insert in the mortgages securing public utility bond issues provisions that make the amount of bonds that may be issued dependent upon the net profits of the utility and assure, as far as it is possible, a certain fixed relation between the amount of the interest charges of the utility and the amount of net earnings available from its operations for the payment of such interest.

The Southern California Gas Company, a well established public utility operating in the southern part of the state of California, if it desires to raise new capital through the sale of any of its first mortgage 6 per cent bonds, must, under the terms of this mortgage, show that its net profits during a given period available for bond interest have been at least one and one-half times the amount of the interest on all the outstanding bonds and upon such additional bonds as it may desire to issue under the same mortgage.

There is active competition in the sale of investment securities to private investors, savings and other banks, life and fire insurance companies and other investment institutions and investors are constantly and actively importuned through circulars sent through the mails, through public advertisements, by letters and through the personal solicitation of traveling representatives of investment bankers. The November, 1913, issue of "Standard Bond Offerings," published by Standard Statistics Bureau, New York City, "a cumulative record of the bond offerings and wants of over 160 reputable bond houses in the United States and Canada for the previous twelve months" listed more than 4600 separate and distinct issues of investment bonds. Bonds of any company must be offered to investors in competition with these thousands of other investment securities and unless its bonds and stocks are protected by a substantial margin of earnings in excess of bond interest and dividends and in other respects conform to the standards of safety established in the investment world and in their quality are equal to or better than other securities, investors, who are free agents in the disposition of their capital, will simply turn to other securities which do have an ample margin of safety, are protected by sinking funds, earnings provisions and equity clauses in the mortgages securing the bonds offered to them and contain such other features as are necessary to inspire their confidence .

This list of bond offerings does not indicate the full extent of the opportunities offered for the profitable investment of capital in large amounts. Vast sums of money, which might otherwise be available to the gas and electric companies of this state, are being devoted to the construction of street railways and interurban railways, to the subdivision, developing and marketing of large tracts of land, to the development of mines and to the production, refining and marketing of oil. The demand for capital for these and other enterprises is particularly large and insistent in the state of California and this condition has an adverse influence on the ability of gas and electric companies to secure new capital and also tends to increase to them the cost of such new capital as they may succeed in attracting to their business. The capital available for investment purposes in the city and county of San Francisco and in the state of California is not sufficient for the development of its natural resources; the upbuilding of its public utilities and to meet the demands of the state and of the cities, counties and other political subdivisions thereof for public improvements and, for this reason, public service corporations are compelled to seek most of the new capital needed by them in the eastern states and countries of Europe far removed from the location of their properties. This condition contributes substantially to the difficulties of securing new capital and enhances the cost thereof.

Permanency of Utility Enterprises.

The property of a gas and electric enterprise is irretrievably placed in the service of the public and its owners cannot, at their will, wind up the affairs of the corporation and liquidate and distribute its assets. The financial, engineering, operating and commercial management of such gas and electric enterprises is constantly beset with hazards and difficulties arising

from financial stringencies, from the competition of other forms of energy, from the actual and potential competition of other like utilities, from the actual and potential competition of municipally owned utilities, and from the diminution of revenues through the improvement of lamps and other current consuming devices, from the constantly growing burden of taxation, from the constantly increasing cost of labor and continual demands of organized labor for higher wages, from the changes in processes of manufacture and improvements in the mechanisms employed in the manufacture and distribution of their products with which they must equip themselves and for which the necessary capital must be found, from the regulation of rates which, in the final analysis, are determined by the interested rate payers, from the uncertainties arising out of rate regulation once every year, from the destruction of property by the elements, and from the liability for compensation to thousands of employes engaged in hazardous occupations. Whatever may be the result of these conditions the utility must remain and suffer the consequences.

An Appeal for a Greater Rate of Return.

According to the 1913 report of the comptroller of the currency, the 504 national banks contained in the Pacific states for the year ended June, 1913, paid dividends amounting to $10,381,416, 11.94 per cent of the capital of these banks. The net earnings to capital and surplus of all of the national banks in the United States were 9.06 per cent during the same year and during the 44 years from 1869 to 1913, the percentages of earnings to capital and surplus of these banks averaged 8.65 per cent. If, under government regulation, capital may be employed in the business of banking, with the confident expectation of such profits as these, gas and electric enterprises of the state of California, to say the least, should not be limited to any smaller rate of return.

GENERAL ELECTRIC ANNUAL REPORT.

The annual report of the General Electric Company for 1913 shows that the business done during the year in the value of the orders received exceeded in volume the record of any previous year. These orders were valued at $111,819,000, and the amount of sales billed was $106,477,000, the net profit from sales and income from other sources $14,065,789. There was paid in interest charges and charged to discount on debentures and notes the sum of $1,007,910 and $8,149,204 in dividends, leaving $4,908,674 to be carried to surplus account. The increased number of orders and expenses of filing them, together with increased competition, caused an unavoidable addition to the expense account. The number of employes on December 31 was 65,000. The patent account is carried at $1, although nearly $663,000 was spent for patents and expenses of the same during the year. Stocks and bonds have a valuation of $25,964,000, of which $17,574,843 represents stocks of subsidiaries and $8,389,473 in stocks and bonds of public utility and other companies. Subsidiaries have had liberal advances during the year to provide increased working capital, and the total amount due from the companies is $6,817,563, making the aggregate balances of all accounts and notes receivable $33,028,000. In July last year nine months' notes for $8,000,000 were sold, but money was deposited out of current funds to meet them. Chairman Coffin says the company has no other paper outstanding, notwithstanding the strain of last year's unsettlement. The report should be considered in every way satisfactory by shareholders, as the company came through troublous 1913 with flying colors and faces the future with confidence.

MINERAL INDUSTRY IN CALIFORNIA.

In the early years of its existence California was a mining State, pure and simple. To-day the mineral industry receives little attention from the public at large, yet it is greater and more extensive than in the palmiest "early days." Gold was discovered in 1848. The output for the following year amounted to $10,151,360. In 1852 it had grown to a total of $81,249,700. With the years succeeding this maximum production the mines of the State continued to yield fabulous wealth, but in decreasing amounts, until their fame became gradually dimmed. The low water mark of the industry was reached in 1889, when the total mineral output equaled $16,681,731, over $11,000,000 of which was gold. That year also marked the beginning of the present era of practical and scientific development of the varied mineral resources of the State. Improvement in methods of development, treatment and management has increased the annual gold production to about $20,000,000—a figure which has approximately held for the past ten years.

The discovery and development of oil-bearing territory has been the largest single factor in the recent growth of the mineral industry, although the building up of the cement industry, and the exploitation of deposits of the widely varying structural and industrial materials which are now commercially produced, have all helped materially in causing it to reach its present gigantic proportions.

The following interesting data are presented by State Mineralogist Hamilton, graphically illustrating the regeneration of the mineral industry in California since 1889. The estimated figures for 1913 are based on partial returns from individual producers in the State and are conservative in every case:

Value of Annual Mineral Output for Various Years, 1889-1913.

1889	$16,681,731	1908	$66,363,198
1894	20,203,294	1909	82,972,209
1899	29,313,460	1910	88,419,079
1904	43,778,348	1911	89,747,879
1906	46,776,085	1912	91,472,385
1907	55,679,949	1913 (Estimated)	100,000,000

Mineral Output for 1905 and 1912, With Comparative Estimates for 1913.

Substance.	1905.	1912.	1913.
Petroleum	$ 9,007,820	$41,868,344	$ 46,000,000
Gold	19,197,043	19,713,478	20,000,000
Cement	1,791,916	6,074,661	8,000,000
Copper	2,650,605	5,638,049	5,500,000
Crushed rock and granite	2,070,607	5,473,928	6,000,000
Brick	2,273,786	2,940,290	3,000,000
Borax	1,019,158	1,122,713	1,250,000
Natural gas	102,479	940,076	1,250,000
Silver	678,494	799,584	800,000
Quicksilver	886,081	866,024	700,000
Other minerals, including asphalt, clay, lead, marble, mineral earths, salt, tungsten, zinc, etc.	3,391,238	6,035,238	7,500,000
Totals	$43,069,227	$91,472,385	$100,000,000

UNDERGROUND ELECTRIC MINE HAULAGE

PROPER VOLTAGE FOR UNDERGROUND TROLLEYS.

BY G. L. PERRIN.

(This article was presented as one of the papers before the recent section meeting of the Nevada Industrial Safety Conference, and should be read in conjunction with those other papers on this subject published in a recent issue of this journal.—The Editors.)

An unprotected bare wire is more or less dangerous regardless of potential, if proper precautions are not observed with regard to distance from rails and location as to chutes and switching stations. If trolley wires were kept at least 7 ft. above rails and protected near chutes and switching stations, and steel, and so forth, were not allowed to be carried through

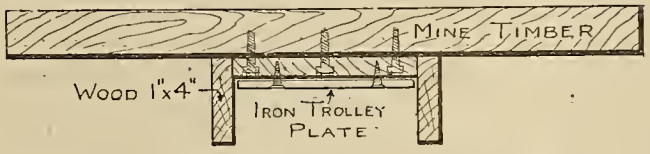


FIG. 1.

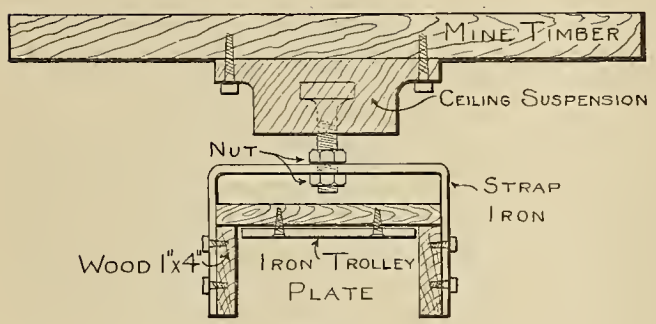


FIG. 2.

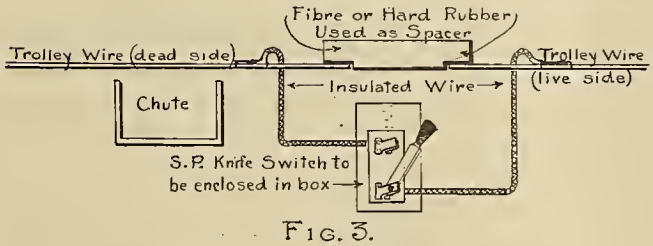


FIG. 3.

Details of Trolley Protection Troughing.

the drift or tunnel, I do not think 110 volts could be classed as dangerous, but would recommend that voltages exceeding 440 be discouraged for underground work.

I do not know of any advantage, as far as safety is concerned, of a.c. over d.c., or vice versa, except that the d.c. single trolley has the advantage over a.c. three-phase, inasmuch as theer are fewer wires to watch.

Trolley wires can be protected by troughing. This can be best installed by substituting iron plates for wires, these to be bolted to a board 1 in. x 4 in. with sides of the same dimensions, also of wood. In dry places these troughs can be nailed to timbers, using the wood as insulation between line and ground. However this can only be approved in exceptionally dry places. (Fig. 1), while for damp places, the same troughing scheme can be employed, but insulated from timbers by bolting trough to an iron strap which is in turn bolted to an ordinary trolley ceiling suspension (Fig. 2.)

For further protection around chutes and switching stations, sectionalizing switches to cut off the current from the part of the trolley near which work is going on, seems to me to be almost a necessity regardless of what other means of protection are used. This latter scheme (Fig. 3) is employed by the Nevada Hills Mining Company and has proven very satisfactory.

While I am not aware of the single-phase type of locomotive being either manufactured or used extensively for mine service, I believe it to be the next step forward in underground mine haulage. In fact the variable speed, single-phase motors as manufactured by the General Electric and Wagner Companies, are well worth investigating by those considering the building of locomotives for mine service.

I have constructed two locomotives for use in hauling loaded cars from the ore chutes of the Nevada Hills Mining Company to the station. They are equipped with three-phase, 440 volt, induction motors, geared to the axle by a chain belt. The current is taken from two overhead trolleys, the rail representing the third leg. They have been economical in maintenance, but have caused injury from electric shock to the workmen in the mine.

Coal briquets to the amount of 181,859 short tons, valued at the plants at $1,007,327, were manufactured in 1913, according to Edward W. Parker, of the United States Geological Survey. The figures for 1913 show a decrease of 17 per cent in the tonnage of briquets manufactured, but an increase of over 5½ per cent in value over the figures for 1912. Seventeen briquetting plants were in operation during the year. Seven of these used anthracite culm or "fines," five used bituminous or semi-bituminous coal, two carbon residue from oil-gas works, and the others used mixed coals. Coal-tar pitch is the principal binder employed, eight plants using it. Patented binders were used at five plants. If the future of this infant relative of the coal mining industry is to be judged by the record of 1913, the judgment should be based on the increase in value rather than on the decrease in tonnage. An exoeption to this decrease is to be noted on the Pacific Coast, the production in 1913 was exactly double that of 1912, with a gain in value of somewhat larger proportion. Mr. Parker believes that the briquet as a domestic fuel is bound to increase in popular demand as its good qualities come into more general notice. The briquets which appear to meet with greatest favor in the Eastern states are of the boulet type, egg or pillow shaped and about the size of anthracite nut. The briquets that are practically smokeless, as they should be, make an ideal fuel for the open grate or kitchen range, holding their shape until entirely consumed and then falling, when stirred, into a pulverulent, clinkerless ash. In the Central and Pacific Coast states the popular type of briquetted fuel appears to be the larger size, about that of egg coal, for which the raw materials available seem to be best adapted.

ELECTRIC PUMPING AND IRRIGATION

PUMPING FOR IRRIGATION.

BY E. V. BERG.

(The author describes the various systems and economies of pumping for irrigation and describes, in closing, a particular central station pumping plant installation.—The Editors.)

Of late years irrigation by mechanical means has been steadily growing. This method of applying water to arid lands is destined to become still more widely used. Practically all lands easily susceptible of irrigation by gravity, namely, by diverting water from a stream into a grade canal, have now been put under ditch. Much of the land remaining in the arid states and fit for cultivation must be watered by the use of pumping machinery.

Several years ago a feeling of doubt existed as to the feasibility and reliability of using pumping machinery for irrigation purposes, the pumps, motors and engines had not reached their present high state of perfection; but any feeling of doubt as to the success attained by a modern plant is dispelled by observing the records of existing plants. The development of the centrifugal pump, for example, has been coincident

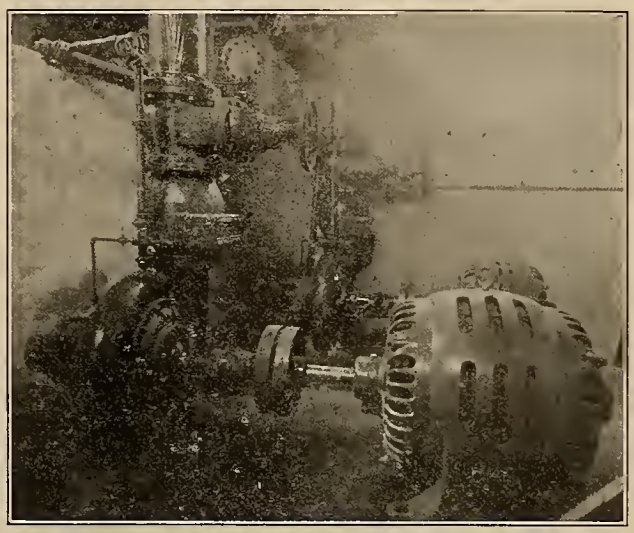


Central Pumping Plant Located on River-Bank.

with the growth and improvement in all lines of machinery, and people have come to recognize the centrifugal pump as a piece of apparatus having a distinctive field. It is one means by which thousands of acres of otherwise worthless land have been made to at once provide homes and produce exceptional crops.

Pumping for irrigation is practiced in a variety of ways and by a variety of methods. The water may be raised from a river to the high land above, it may be taken from a gravity canal and applied to higher lands, or it may be lifted from dug wells to the surface of the ground. The principles involved and power requirements, though the same in each case, varies. For example, when pumping from deep wells the vertical submerged centrifugal pump is used, or, in some cases, the air lift pump, while in the other two cases mentioned the horizontal type of centrifugal pump finds more general application. The centrifugal pump is driven by an electric motor, or one of the various kinds of engines, steam, gas or oil. In special cases and where conditions are favorable, hydraulic rams, air lift pumps and even windmills are used.

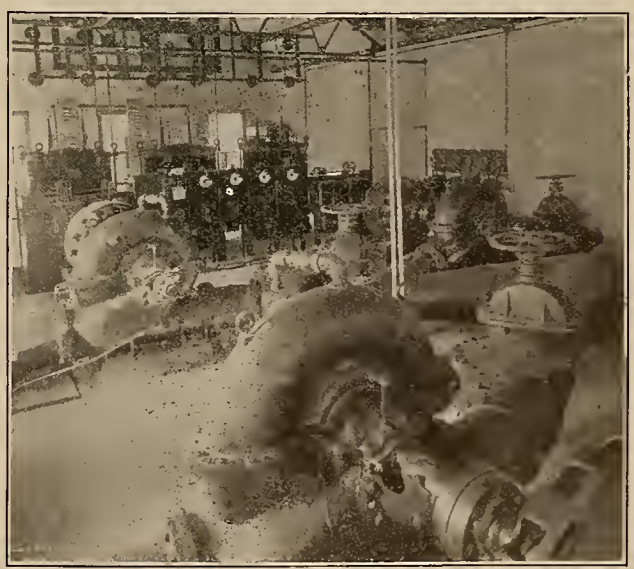
The particular way in which water is raised, owing to best adaptation of the land to be irrigated, often determines whether the isolated plant, the small plant supplying a small acreage, is to prevail, or whether it is to be the large central station, often supplying irrigation for thousands of acres to hundreds of land owners. Arguments may be presented for or against either system, as in the case of electric stations



An Individual Pumping Installation.

for power distribution, though in the case of pumping the small isolated plant is more advantageous than the isolated electric plant.

In California individual or isolated pumping plants predominate. The water is raised from wells having a limited capacity to be applied to a comparatively small acreage, and the land and water system then belongs to and is in the control of one man. In Idaho the case is different. Here the large or central station



Interior of a Central Pumping Plant.

plant predominates, since the water is taken from rivers or large canals having practically an unlimited supply. The system is run by an organization having proper officers, and each individual is simply a part of the company. While the larger pumping stations

are more economical of operation, from a mechanical standpoint, they are apt to be somewhat less economical than the small plant in the use of water. In the latter case, one person has control of both his land and water, and can run his farm as carefully and economically as possible.

The writer's irrigation experience is largely confined to the State of Idaho, and what follows is written



A Removable Flash-Board.

as a result of that particular experience. As is well known, Idaho has within its borders more large gravity projects, as well as pumping projects, than any other state in the Union. The people have availed themselves of the Carey Act as a means of land development to a greater extent, it is believed, than all the other states combined. In addition to this, the Reclamation Service has several large projects, both gravity and pumping; in fact, their pumping project on the Minidoka tract, covering nearly 50,000 acres, is one of the best equipped and most successful in the world. Another plan of building irrigation works is by the creation of irrigation districts in which all land owners combine and by bonding their property are able to raise money for construction. Under the Carey Act private individuals may make a contract with the state for the construction of works to irrigate certain lands. The work is done under the supervision of state authorities, and the construction company is then allowed to sell its water which was made available to the land at a price fixed by the State Land Board. Pumping systems, practically all of which have proven successful, have been constructed in this state under all these different methods.

In a state where gravity projects and pumping projects are often adjacent, comparisons are sometimes made of the relative merits of the two plans, of the cost of construction, operation and so forth. It is difficult to find a proper basis of comparison regarding construction, though it is this cost which generally determines whether a particular piece of land shall be watered by gravity or pumping. Usually the cost of a dam or reservoir and ditch lines, if possible at all, would be prohibitive where a pumping system would be entirely feasible and comparatively cheap. In comparing the operation of the two systems, not only should the actual physical operation of plant and canals be taken into consideration, but the kind and amount of crops, and, finally, the profit earned per acre under each system. Pumping systems require more careful management and supervision in the handling of water than is necessary under gravity flow, since in the former the cost of operation is in direct proportion to the amount of water used, while this is not the case under gravity.

It is for this reason that pumping projects are not always immediately successful from an operating viewpoint. When there are a number of farmers on a tract raising diversified crops, needing water in different amounts and at different times, and not making any special effort toward co-operation, the system cannot be operated as economically as when all interested are alive to the fact that there must be co-operation and that the best farming methods must prevail. The ideal condition would be where the management of the land and water was in one person or organization. Then the most profitable crops only would be farmed, the water would be economically used, and machinery would be applied to do all farm work on the largest scale. Thus we see that on a large project containing many individuals, it is the human element that makes for success or failure of the project as a whole. However, it is the belief of the writer that the incentive to economy required by a somewhat higher maintenance and operation charge will lead the land owner to a more careful study of crops, to apply better farming methods and to co-operate with his neighbors for the general good. It seems that these things must lead to greater production, acre for acre, of the crops that pay, over those produced under the average gravity system, and this, together with the prevention of injury to the land itself, which, through careless handling, so often occurs under gravity systems, will much more than counterbalance any added expense in the physical operation of one system over the other.

There are two fixed items in the planning of a height of lift and cost of power. In determining the cost per acre foot or other water unit. These are heights of lift and cost of power. In determining the



Drop With Baffle Wall.

proper height of lift, it is necessary to have a topography map of the land to be irrigated, from which the number of lifts which will keep the average elevation at a minimum, may be found. A practical minimum is meant, as it would not pay to divide the total height into too many parts, thus entailing too great a construction cost, without a corresponding saving in operation. The limit of height to which water may be

profitably pumped depends upon the kind of crops raised. It is believed that with the prevailing price for power that an average lift of 60 ft. for grain and hay crops is about the upper limit in this state. For potatoes, peas, beans and vegetables of this class, the height might be raised to 100 ft., while for a still higher class of product, such as fruit and clover, flower and vegetable seeds, a lift of 200 ft. is practicable.

In the matter of power or the kind of prime mover employed to drive the pumps, location of the land to be irrigated is one of the determining factors. In a region where oil fuel is cheap, oil, gasoline or steam engines are used to a large extent, but in parts of the country where oil is expensive, and water power plentiful, as in this state, practically all pumping is done by means of electricity. The electric motor is an ideal drive for centrifugal pumps, and is so much superior to every other method that wherever possible it is given the preference. The cost of electric power for irrigation depends on whether its generation is part of the general irrigation scheme or whether it is bought from a separate power company. In the former case, the cost is net, or as much as it costs to generate the power, while in the other case contracts are made for a certain sum per horsepower per irrigation season. The price depends on whether the service is 20 or 24 hr. per day. The prevailing 24 hr. per day per season rate is $18 per h.p., based on maximum demand. In some cases a meter rate is made in addition to a certain fixed monthly charge. Both rates have advantages, though the latter method gives a little more incentive toward economy on part of water user.

An incidental advantage of great importance in connection with the electric pumping systems is the distribution of electric power for farm purposes. The service wires are run from the pump substation throughout the tract, and power and light are made available to all who desire it. Power conveniences are a great help toward keeping up a general tone of satisfaction among the farmers, and tend toward a more neighborly feeling.

The writer is connected with a project called the High Line Pumping Project, containing about 3700 acres, on which the average lift is 45 ft. The installation is typical of the pumping plants built in this state, and a general description might be of interest.

The land in the project is under two lifts, 3000 acres under a 40 ft. lift and 700 acres under a 68 ft. lift. A careful contour survey fixed these lifts as being at the most economical elevations. Three 15 in. centrifugal pumps were installed, each having a capacity of 13 sec. ft., or about 1 acre ft. per hr. On this basis the three pumps would cover the 3000 acres supplied by them to a depth of about 3 ft. during the irrigation season of four months. This is more than sufficient, and it is believed that two pumps will throw enough water for all purposes, which leaves the third machine as an emergency unit. These pumps are of the double suction, split case type, made by the American Well Works Company of Aurora, Ill., and are direct connected through flexible couplings, to 100 h.p. induction motors. The motors are Form L General Electric, having internal starting resistance. There are 700 acres under the 68 ft. lift, and are served by two 8 in. pumps, connected to 50 h.p. motors, both pumps and motors being of same type as the larger machines above mentioned. Wood pipes are used to convey the water from the pumps to the canals, the three 15 in. discharge pipes combining in a 32 in. pipe, and the two 8 in. pumps discharging into a 22 in. pipe. There are no reservoirs on this system, but water is pumped directly into concrete basins from which, canals take out in opposite directions. Both motors and pumps are thoroughly protected by safety devices, each motor having a separate switchboard panel containing no-voltage and overload release, and the pumps being provided with both check and gate valves in the discharge.



Exterior View of Central Pumping Plant.

The substation adjoining the pumping plant contains two banks of transformers, each having a capacity of 225 kw., together with choke coils, electrolytic lightning arresters and automatic switching devices. The current enters at 22,000 volts, and is transformed down to 2200 volts, which is the operating voltage of the motors.

This system has been in successful operation for three years, and with the small apparent wear and tear thus far, would indicate that a depreciation of 2 or 2½ per cent would be ample when figuring the life of the plant.

That municipal gas plants do not succeed in selling as large average quantities of gas per consumer as do private companies was the gist of a paper on "Municipal Gas Undertakings and the Consumer," presented by Robert Watson of Doncaster at a recent meeting of the Manchester District Conference of British Commercial Gas Association. Substantive statistics were given. The development of municipal plants is greatly hampered, he said, by opposition to anything that might be classed as municipal trading, whereas there is no such interference with the progress of private companies. In the face of such obstacles municipal authorities cannot do their best to stimulate gas consumption, and in the long run plumbers, gasfitters and hardware dealers suffer from the restricted use of gas. During the discussion which followed, this opposition was also commented on by other speakers.

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Capitalization of Water Rights

It is left to the highest courts to interpret the spirit of the law—the highest sense of justice. In a recent decision, printed in this issue, the Supreme Court of the United States emphasizes the importance of the principle, that there can be no justice in equality where enterprise is not equally advantaged. This is one expression of the spirit of the law.

It used to be contended that water must be the property of all, just as is light, and the air we breathe, for water is essential to life. But its equal distribution or its withdrawal from improved or exclusive use of surplus, is something which can only be invoked when equal distribution is essential because of waste or the then non-existence of that surplus.

In the interim, improvements are beneficial to all. But all cannot and will not make such improvements, though all have equal opportunity to do so. Is it not just, therefore, that the individual—prospector, speculator, or pioneer, as you will—who makes the improvements should be the one most to benefit? And not only by earnings upon the capital invested but because of improvement in the water right—the unused and neglected property and possibilities of the people.

A water right unimproved is waste, and it is present waste which is responsible for the high cost of living and the still higher cost which is the promise of the future.

Whatever will eliminate this or tend to do so, should be proportionately rewarded and it is not altogether surprising to find that the highest court of the land in its highest interpretation of the law, finds that capitalization of water rights, in estimating plant valuation for rate-making purposes, should be allowed.

No court has questioned the capitalization of water rights except for irrigation. The question has been raised by railroad commissions in the case of hydroelectric power companies and consequently this decision is of wide interest.

This particular decision deals with these rights in connection with the sale of water for irrigation purposes but the contention of the court, that by such sale all do not benefit directly, but a part of the people only, and for their private benefit, makes this ruling applicable to all utilities utilizing water rights—hydroelectric companies with others.

It was argued, that under California law, should the holder of a water right appropriate the water to distribution and sale, he thereby dedicates it to public use and loses its private right in it.

The court contended that such an appropriation and use does entitle those within reach of the water to demand a reasonable share upon due payment but pointed out that the holder, or water company, has the sole right to furnish this water which could not be secured by the owners of irrigable lands, but

through the company. That fact must be taken into consideration in determining rates.

As further pointed out, it seems unreasonable to suppose that the declaration in the Constitution of 1879, that water appropriated for sale is appropriated to a public use was intended to compel a gift from the former owner to the users or that if in dealing with waters "appropriated for sale" it meant that there was actually nothing to sell.

This decision does not state specifically that all water rights may be capitalized, those appropriated as well as those acquired for a valuable consideration, but it practically establishes the principle that not to permit capitalization of water rights is to deprive the owner of them without due process of law, which is an infringement of constitutional rights.

The manner of arriving at this valuation is a different matter, and while many methods have been suggested, that which will be most equitable will be one which is based upon the measure of the complete utilization of the water right and its most beneficial use.

Co-operation in Opposition

"Like adversity, adverse decisions make strange bedfellows," comment the newspapers in effect, for arrayed in an appeal for rehearing of the now important Oro Electric case are both the California Railroad Commission and representative corporations—the controller and the controlled.

And this comment would not be called forth but for the fact that it is only a seeming strangeness.

The legal, is a wordy warfare in which power goes to the victor because of right; law, as shown in a recent editorial, being but a reasoning up to the right.

These two powers—the corporation and the commission—though opposed, are actually operating together in the interests of that section of the public they both serve, thus exemplifying co-operation in opposition.

It is inadvisable to endeavor to secure your rights under and within the law, whenever those rights inflict a wrong upon those to whom you are in opposition.

The law of reasoned right is for all, and for the public service commission which will ignore precedent and in the best interests of all involved will judge of things as they are, there can be but the highest commendation and praise.

It is an economic principle, that where regulation of public utilities, whether state or municipal, obtains then competition must be restricted. The principle of regulation may be involved only where monopoly prevails. If you must have regulated competition, regulate it, but not the sale price of the product, or, rates.

Let them so soar, as they must of necessity, that a disgruntled public will eventually desire a return to monopolistic service.

It is very elementary that duplication of distribution systems increases the cost to the consumer; is inefficient and wasteful. It is not effective in reducing rates because it adds nothing to the service, than may be added through regulation, but cost.

The purblind selfishness of any public utility which would insist upon competition with rate regulation can not but create suspicion and react upon private owenrship in general.

And the question arises, should there be one law for rural districts and for those who, perhaps in wisdom, delegate the regulation of their utility affairs to the commission, and another for those who do not?

If this journal were opposed to the regulation of utilities by municipalities it would be on the grounds that the public themselves, as a municipality, may at any time become the competitors of the utility they regulate, in which event, except at great legal expense (also borne in duplicate by that same public) there would be no power to regulate the regulator.

Moreover regulation of public utilities is a matter of extremely expert knowledge and ability combined with the power to rise to the occasion. It is not something which may be undertaken by every Tom, Dick or Harry merely because authorized by the people on their behalf.

If this fact were fully appreciated such absurd situations would never occur as recently arose in one city where a utility, by the figures of the municipality's own public service experts, is to be allowed an estimated rate of return upon its investment of but 3½ per cent.

In municipal regulation there is a constantly recurring possibility of injustice which it would be well to anticipate by extending the power of state commissions so that they will be enabled to regulate all the public utility business, municipal or otherwise.

This situation, promising one law for all people and its uniform interpretation, is worthy legislative consideration and the enactment of whatever is necessary in order to extend the powers of public service commissions to that end, for there is no opposition between the public, through its accredited commission and the utilities it controls, but a friendly fight for the establishment of what is right.

The Age Practical

You live in the age practical. Your theory must be demonstrated to prove its utility. Then the world will supply an attentive audience. The realization of our ideas of the practical constitute the difference between the civilizations past and that of today. Unless you are prepared to prove your ideas practical none will listen though the possibilities they contain are vast. "Show me!" leaps to the lips to preclude doubt and doubt lingers until your demonstration of utility is complete.

In an endeavor to achieve the intensely practical is questioned that which has been done before. Today we investigate that the performance of the morrow may be more complete. It is a search after Truth. As soon as you question you open up the avenues of advancement which your performance then makes possible.

But questioning without honest investigation is complaint; investigation without understanding but increased ignorance; understanding without action causes atrophy and a too early death.

We must investigate, understand and act.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

Frank J. Somers of the Century Electric Company, San Jose, Cal., is at San Francisco.

F. H. Cable has been appointed test engineer of the Pacific Light & Power Corporation, Los Angeles.

Frank Cavenagh, Pacific Coast manager, Metric Metal Works of American Meter Company, is at Los Angeles.

C. V. Schneider, president Electric Supply Company, Sacramento, was at San Francisco recently on business.

H. H. Howell of the Howell Electric Company, San Diego, Cal., was at San Francisco on business during the past week.

W. L. Goodwin, vice-president Pacific States Electric Company, San Francisco, has returned from Southern California.

M. Wm. Hild, of the Electric & Machine Equipment Company, Stockton, Cal., was a San Francisco visitor during the past week.

M. A. Stamfer will build that part of the new line of the Nevada-California Power Company into Imperial Valley, between Banning and El Centro.

O. B. Coldwell, general superintendent of the Portland Railway, Light & Power Company, has returned to Portland after a week's visit in California.

S. B. Gregory, Pacific Coast manager, Arrow Electric Company, has returned to San Francisco, having made a business trip through the northwest.

W. R. Pounder, Pacific Coast representative Hubbard & Company, has returned to San Francisco from a business trip made through the northwest and Montana.

W. de P. Tardiff has severed his connection with the Holabird-Reynolds Company and is now city salesman with the Electric Appliance Company, San Francisco.

H. F. Holland, representative of the Simplex Electric Heating Company, left Salt Lake City this week for a month's trip to Los Angeles and other Pacific Coast cities.

A. E. Barlow, Pacific Coast sales manager, and **J. W. Leighton,** of the American Eveready Works of National Carbon Company, were visitors at Seattle last week.

F. H. Poss, Pacific Coast manager Benjamin Electric & Manufacturing Company, San Francisco, is on a vacation trip through Lake and other counties north of the bay.

D. A. Taylor, secretary and treasurer H. Northwood & Company, Wheeling, West Virginia, manufacturers of "Luna" and other lighting glassware, was at San Francisco last week.

E. M. Herr, president of the Westinghouse Electric & Manufacturing Company, left last week for the East via Portland and Seattle, having spent several weeks visiting California cities.

E. E. Gray of the Hotpoint Electric Heating Company, has spent the last week at Salt Lake City making preparations for the celebration of "Hotpoint Week" by the various electrical interests.

C. B. Hall of the Illinois Electric Company, at Los Angeles, and **R. D. Holabird** of the Holabird-Reynolds Electric Company at San Francisco, are attending the jobbers convention at Atlanta, Ga.

Mortimer Freund, associated with Percival R. Moses, consulting engineer, has been superintending the electrical and mechanical installations in the new Hudson Bay Company's store at Vancouver, B. C.

A. V. Olson, formerly associated with the Pacific Coast office of Pass & Seymour, is now with the Electric Railway & Manufacturers' Supply Company at San Francisco.

G. C. Pierce, vice-president and general manager, Santa Monica Water Company and Sawtelle Water Company and of the Santa Monica Mountain Park, Santa Monica, Cal., stopped off at San Francisco during the past week. en route to New York.

Melcher Ekstromer, electric vehicle specialist with the Electric Vehicle Company, is at Salt Lake City from Denver in connection with some large deals on electric trucks under consideration there by two of the large department stores.

C. E. Hearn, the popular specialty salesman of the Electric Appliance Company, has left on his initial trip as territory representative in Southern California and Arizona. **Grover Anderson** will occupy Mr. Hearn's place at the San Francisco office of the company.

S. R. Inch, general superintendent; **W. R. Putnam,** new business manager, both of the Utah Power & Light Company, and **C. A. Cohn,** superintendent of power stations of the Utah Light & Railway Company, will attend the convention of the National Electric Light Association at Philadelphia early in June.

Arthur Walser, district manager of the motor department of the General Electric Company's Denver office, has not transferred his headquarters to Salt Lake, as was recently stated in these columns by error, but will continue to work from Denver, having recently returned there from Salt Lake City.

W. R. Steudemund, Pacific Coast manager, Gillinder & Sons, Philadelphia, Pa., is leaving San Francisco for a trip through the Pacific Northwest and British Columbia. Mr. Steudenmund will go East on his annual trip to the company's head office and works, returning to San Francisco the latter part of July.

P. B. Sawyer, vice-president and general manager of the Utah Power & Light Company, has returned from a three weeks' trip through the East. While away he attended a meeting of financiers interested in power projects in the West, **D. C. Jackling,** president of the Utah Power & Light Company, being among those present.

A. G. Pratt, assistant to president, Babcock & Wilcox Company, manufacturers of water tube boilers, is making a tour of the Pacific Coast. He will be accompanied by **Elgin Stoddard,** vice-president and general manager of Chas. C. Moore & Company, Engineers, who represent Babcock & Wilcox on the Pacific Coast.

George Kidd has been appointed general manager of the B. C. Electric Railway Company, Ltd., at Vancouver, B. C., to succeed **R. H. Sperling,** who has been appointed assistant to the chairman of the board of directors with a seat as director. In making the new appointment the board expressed its sincere thanks to **F. R. Glover,** general executive assistant; **C. R. G. Conway,** chief engineer, and to all other officers of the company for their services and loyalty during Mr. Sperling's administration.

Carlton R. Rose, for a number of years superintendent of the United States Zinc Company, Pueblo, Colorado, subsidiary to the American Smelting & Refining Company, has recently resigned his position and become an associate of Smith, Emery & Company, inspecting, testing and chemical engineers and chemists. Mr. Rose will be located at San Francisco and will take an active interest in the business. His strong and pleasing personality and varied experience in university work and practical accomplishment will add materially to the strength and range of the firm.

John P. Mallet, member A. I. E. E., has been appointed by the Society for Electrical Development, Inc., to investigate present and possible power applications. The information thus gathered will be turned over to the Commercial Exchange Bureau which has been inaugurated in charge of **Theodore Dwight** for some years assistant secretary, American Institute of Mining Engineers. Other appointments of the Society and recently made are: **James Smieton Jr.,** office manager and secretary-treasurer; **H. C. Spaulding,** in charge of news and advertising department, with **Harry Chapin Plummer** as assistant.

Otto B. Goldman, contracting engineer, Portland, Ore., has been elected an associate member American Institute Electrical Engineers. Other western associates elected at the

April meeting were: **Walter C. Clark,** superintendent Light & Water Systems, Kellogg, Idaho; **Herbert J. Gray,** sales agent Canadian General Electric Company, Vancouver, B. C.; **Bernhard Olsen,** motor agent, General Electric Company, Spokane, Wash; **J. H. Paget,** meter engineer, B. C. Electric Railway Company, Ltd., Vancouver, B. C.; **Foster Russell,** commercial engineer, Washington Water Power Company, Spokane, Wash., and **Wm. K. Stacy,** assistant to electrical engineer, Washington Water Power Company, Spokane, Wash.

Allen C. Morse, who for many years has been engaged in engineering work, has been chosen as resident engineer and manager of the new office of the firm of McMeen and Miller, at 407 Electric Building, Cleveland, Ohio. which will co-operate with the Chicago office of the firm in the general conduct of its business. At its Cleveland office, McMeen and Miller will continue to serve, not only public service corporations, municipalities and commissions as may be required, but will devote particular attention to the rehabilitation of plants, the making of appraisals, the establishment of proper systems of records, and to any other work in which they may properly serve the interests of their clients.

OBITUARY.

J. C. H. Stut, well-known as a designing mechanical engineer, died at Oakland, Cal., on May 7, 1914, aged 63 years. Mr. Stut was born in Germany and started as a blacksmith's helper at San Francisco in the early seventies. His studious application was gradually instrumental in his rising to the top of the profession. From 1878 to 1886 he was draughtsman with the Union Iron Works. In 1887 he designed and promoted the cable railway on Howard and Ellis streets in San Francisco and in later years was closely associated with the development of the cable roads in that city. The great Dutch windmill in Golden Gate Park was designed by him and stands as a monument to his ability. At the time of his death he was consulting engineer for several corporations, including the Union Sugar Company. His death marks the passing of one of the few who remain of the "old guard."

MEETING NOTICES.

Portland Sections A. I. E. E. and N. E. L. A.

A joint meeting was held on Tuesday, May 5th at 8 p. m., at the Assembly Hall, Hawthorne Bldg., Portland, Oregon, when an illustrated lecture on some of the Economic Problems of a Public Utility was presented by F. W. Hild, manager, Portland Railway, Light & Power Company.

Oregon Society of Engineers.

Ralph Modjeski gave an illustrated talk on The New Quebec Bridge in Room A of the Public Library, Portland, Oregon, on Monday evening, May 4th, at 8 o'clock. Mr. Modjeski is a member of the Quebec Bridge Commission, and this was an excellent opportunity for the members to get information regarding this immense structure at first hand. There was a good attendance.

Pacific Northwest Society of Engineers.

The twelfth annual convention of the Pacific Northwest Society of Engineers will be held at Seattle, June 19 and 20, 1914. The session of the first morning will include reports and technical papers. The afternoon session will probably be occupied with a visit of inspection to the Lake Washington canal locks. In the evening a banquet will be served and Chas. H. Swigart, supervising engineer, Washington division, United States Reclamation Service, North Yakima, will present a paper on the storage problems of Yakima valley. Saturday will be wholly taken up by an excursion over the Milwaukee railroad to the storage dam of the United States Reclamation Service at Lake Keechelus. Joseph Jacobs, Central building, Seattle, is president of the society, and Jesse A. Jackson, Municipal building, Seattle, secretary.

Oregon Electrical Contractors' Association.

The following program has been arranged in connection with the convention of this association to be held at the Moose hall, Portland, Oregon, on June 8 and 9, 1914:

Morning: 9:30—Address of Welcome, J. E. Werlein; Response, President R. G. Littler; Paper, The National Electrical Contractors' Association, Ernest Freeman, national president; The Electrical Jobber, Ross Hartley; The Society for Electrical Development, J. M. Wakeman, manager; Stereopticon Address, Fire Causes and Prevention Suggestions, E. M. Underwood.

Afternoon—Business meeting, members only; 3:00, trolley ride to Council Crest; 7:00, trolley ride to The Oaks.

Tuesday, June 9th: Morning, 9:30—Inspection of local power plants of Northwestern Electric Company and Portland Railway, Light & Power Company.

Afternoon, 2:45—Attend Pacific Coast League baseball game.

There will be a banquet at 8 p. m. on the closing day, further particulars of which will be given at a later date.

Jovian Electrical League of Southern California.

The weekly luncheon on May 6th was presided over by H. W. Allen. There was a splendid musical program and a lecture by Dr. H. C. Stinchfield of the Southern California Edison Company on "Resuscitation by Manual and Mechanical Methods," and a demonstration of the latter by the use of the pulmotor. The doctor, who has saved the lives of many electrical men receiving severe shocks and burns, reviewed the history of resuscitation, first describing the manual methods of Dr. Sylvester, developed in 1858 and the later or prone pressure method, devised in 1890 by Dr. Schaefer. He pointed out the necessity of attending to the victim at once and not to give up the attempt to save, for persons have been saved after three hours' continuous effort. While the doctor gave high praise to the Draeger Pulmotor, which requires oxygen for its operation, he pointed out the advantage of the new lungmotor, 22 of which have recently been ordered by the Edison Company, which does not require oxygen for its operation. Using Secretary Van Kuren as a subject, the doctor demonstrated the two manual methods and the use of the two machines.

In view of the league's interest in the bond election for the completion of the municipal power plant (held on May 8th), a straw vote was taken with the result that out of 85 votes cast, 80 voted against and 5 for the bonds, which some member explained by crediting three votes to the three Glendale members present and two votes to two Pasadena men present, there being municipal plants in both cities.

Utah Electric Club.

At the regular meeting at the Commercial Club Thursday, May 7th, Lieutenant W. B. Wallace of the U. S. Army read a paper on the subject, "The Regular Army in Times of Peace, and Provisions for Its Expansion at War Times." He pointed out how the regular army as constituted in times of peace is intended to serve only as a nucleus of the war army, and that it is the purpose of the Federal government to educate and train the National Guard of the various states as the first reserve to the regulars in case war is declared. For this purpose, regular army officers are assigned to do inspection and instruction work with the various guard organizations, Lieutenant Wallace himself being attached to the Utah National Guard. The club had as its guests at the luncheon the senior engineering class of the University of Utah with their professors. During the luncheon remarks were made by Professors Knowlton and Beckstrand emphasizing upon the boys the advantage of contact with the men who are actually engaged in commercial pursuits during their course in school.

The entertainment committee announced the spring outing of the club to be held at Lehi thirty miles south of Salt Lake City on the line of the new Orem Interurban, Saturday,

May 16th. There will be a baseball game at Lehi in the afternoon between a picked team from the Electric Club and the Lehi team, which won the championship in the Utah County League last year. Dinner will be served the club by the Lehi Commercial Club at 6 o'clock. A wrestling match and grand ball conclude the day's outing, the return train arriving in Salt Lake City at midnight.

Oregon Hydroelectric Commission.

Professor O. F. Stafford, of the University of Oregon, recenty lectured in the Rosarian room of the Commercial Club at Portland on the possibilities of developing a large iron and steel industry here through utilization of Oregon's tremendous hydroelectric resources. The lecture was given under auspices of the Oregon Hydroelectric Commission, of which H. B. Miller is chairman. The full commission was present. Colonel David M. Dunne, president of the Manufacturers' Association, R. W. Raymond, manager of the association, and the board of nine directors attended also with W. A. Graves, president, and other officers and members of the Oregon Society of Engineers. In prosecuting his work at the University of Oregon, Professor Stafford has made an exhaustive study of hydroelectric resources of the Pacific Northwest, and the application of electrical energy to the great metal industry. He has asked the people of Portland to consider the enormous possibilities when the 12,000,000 or more horsepower of available energy to be had in the Columbia basin has been harnessed and offered suggestions as to what might be done in utilizing this energy. It was stated by the professor that iron ores may be brought to the Portland district from China, Mexico, Chile or even Cuba, when the electric eenrgy is sufficiently cheap, and yet compete with iron plants in the Eastern states.

San Francisco Electrical Development and Jovian League.

After the regular luncheon last Tuesday, the league listened to an intensely practical and masterful talk on the Stevens Bill, now before congress, regulating prices of manufactured commodities and providing for publication of same. It was given by A. E. Roth, a San Francisco attorney. W. F. Neiman occupied the chair.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The commission has rendered a decision authorizing the San Diego Consolidated Gas & Electric Company to renew eleven promissory notes aggregating $373,228.88.

The commission has rendered a decision authorizing an issue of promissory notes in the sum of $2,500,000 by the Pacific Light & Power Corporation. The notes will bear interest at the rate of 6 per cent, payable semi-annually. The new issue of notes authorized will be used to retire outstanding notes in the same sum.

The city of Los Angeles has filed a complaint with the commission against the Southern California Gas Company, the Los Angeles Gas & Electric Corporation, the Southern California Edison Company and the Economic Gas Company, in which it asks the commission to enter an order directing the said companies to supply natural gas to consumers in the city of Los Angeles before using such natural gas which the companies draw from Kern county through their pipe lines in the operation of their own plants, and before diverting any natural gas to other localities away from the city of Los Angeles.

The Sacramento and Woodland Railroad Company and the Northern Electric Railway Company have joined in an application filed with the commission, asking for an order authorizing an agreement by which the Sacramento & Woodland Railroad Company will be operated by the Northern Electric Railway Company.

The commission has rendered a decision authorizing the Roseville Home Telephone Company of Roseville, Placer county, to transfer its system to the Roseville Telephone Company for $11,000 in stock of the latter company.

The commission has rendered a decision granting authority to the Mt. Whitney Power & Electric Company to issue $500,000, of its 6 per cent 30 year bonds. The bonds are to be sold so as to net the applicant 95 per cent of the par value plus accrued interest.

EXAMINATION FOR ELECTRICAL ENGINEER AND DRAFTSMAN.

The United States Civil Service Commission announces an open competitive examination for electrical engineer and draftsman, on June 3 and 4, 1914. From the register of eligibles resulting from this examination certification will be made to fill vacancies as they may occur in this position, at $1200 per annum, in the office of the supervising architect, Treasury Department, Washington, D. C. Applicants must have a good common school or high schol education and not less than three years' special experience as a draftsman principally in connection with electrical work, or be technical graduates with not less than ten months' experience as electrical draftsman or practical experience in the installation of electrical wiring or apparatus. A rating of at least 70 per cent in this subject is a prerequisite for consideration for this position. Competitors will be furnished with whatever drawing paper and tracing vellum may be necessary, but they must supply themselves with drawing boards not less than 18 inches square and all other drawing instruments and materials which they deem necessary. Age, 22 years or over on the date of the examination.

Under an act of Congress applicants for this position must be examined in the state or territory in which they reside and have been actually domiciled in such state or territory for at least one year previous to the date of the examination. Persons who meet the requirements and desire this examination should at once apply for Form 1312, to the United States Civil Service Commission, Washington, D. C.

TRADE NOTES.

The Bay Cities Engineering Company completed the feeder and trolley work in connection with the Union Street Municipal Line, San Francisco, no less than 19 days ahead of schedule although no bonus was offered for early completion. This will enable the municipality to at once connect up with the central station supply and so results in a further saving to the city.

Among recent orders obtained by the San Francisco office of Allis-Chalmers Manufacturing Company are two large motors for the California Street Cable Railway, a 1500 kw. turbo generator set, complete with condensers, etc., as well as the complete motor equipment of the new planing mill of the Pacific Lumber Company at Scotia, Cal.; and a complete pumping plant for the South Coast Land Company at Oceanside, Cal.

NEW CATALOGUES.

Westinghouse Electric Type I Oil Switches. Leaflet 3745 describes and illustrates the construction of this type of oil switch which is intended for use on direct or alternating current series lighting circuits and for controlling inductive loads of small capacity.

Leaflet 3512-A describes Westinghouse Electric Auto-Starter for Squirrel Cage Motors. The construction of this device is fully described and illustrated as is also the overload relay with which it is equipped. No. 2364 describes Westinghouse Electric d.c. type K Crane Motors. These motors are designed for severe intermittent, varying speed service where high torque is required such as cranes, hoists, coke charging machines, etc. Complete and detailed views of the motors are given and the more important features of construction described. Folder 4172 describes the Westinghouse Bell Ringing Transformer and shows how it should be installed.

NEWS NOTES

INCORPORATIONS.

PARKLAND, WASH.—The Parkland Light & Water Company has been incorporated.

WALLA WALLA, WASH.—The Walla Walla River Power Company has filed articles of incorporation for $120,000. They plan to start within a few months the construction of a power plant for developing 1800 h.p.

RENO, NEV.—Articles of incorporation naming Reno as the principal place of business have been filed for the Beaver River Power & Plant Company. Wide powers are granted in the articles. The capital stock is $100,000, divided into 100,000 shares. The articles are witnessed in Ada county, Idaho, and name as subscribers to stock H. R. Waldo, Geo. F. Halliday, O. P. McBiersach, E. P. Bacon and H. V. Hoyt.

ILLUMINATION.

AUBURN, WASH.—The Auburn Gas Company has applied for a franchise. Estimated cost of laying mains is $30,000.

EL PASO, TEX.—Plans for the erection of a new gas plant are being considered by the El Paso Gas & Electric Company.

HUNTINGTON PARK, CAL.—The city trustees have rejected all bids for lighting posts and will enter upon the market to buy.

MARTINEZ, CAL.—The Pacific Gas & Electric Company has been awarded the franchise it recently applied for along certain public roads in the vicinity of Stege.

AVALON, CAL.—Private capital is ready to install a gas plant here and application has been received by the board of trustees for a franchise, the plant to be in operation by July 15th.

REDLANDS, CAL.—The city trustees granted a contract to the Independent Electric Company for the extension of the ornamental street lighting system on Orange street from Colton to Lugonia avenue, for $1250.

SEATTLE, WASH.—The city council has passed resolutions providing for the improvement of Madison street, Marion street and Columbia street each from Railroad avenue to First avenue by the installation of cluster lights.

COVINA, CAL.—The board of trustees will receive bids up to May 19th, for furnishing and installing ornamental pressed steel and copper posts with cast iron base and concrete foundation on Badillo and Citrus avenues, ninety posts in all to be placed, fully equipped for street lighting purposes.

CHEHALIS, WASH.—Ben Walling Jr., claiming to represent capital to build a power plant capable of supplying southwest Washington cities with electric power at much lower rates than they are getting at present, has applied for a franchise. The city commission will submit the proposition to a vote of the people.

STOCKTON, CAL.—The state supreme court has granted a rehearing of the case in which it recently reversed a decision of the railroad commission shutting the Oro Electric Corporation out of this city on the grounds that it was adequately served by the Western States Gas & Electric Company. The Oro corporation protested against a rehearing, while many other power companies supported the petition of the commission for a re-opening of the case.

LOS ANGELES, CAL.—The city has voted to issue $6,500,000 bonds to build a plant to develop power from the Los Angeles aqueduct and to acquire a distributing system which will furnish most of the light and power used in the city. The vote was 56,199 to 23,179 in favor of the bonds. Of the money voted $1,250,000 will be devoted to equipping the plant, which will generate its power by means of the water brought in the aqueduct from the Sierra Nevada mountains.

SALT LAKE CITY, UTAH.—Eugene B. Palmer, handling the advertising of Walker Brothers, bankers, of Salt Lake City, in an address before the Salt Lake Ad Club on the subject, "New Applications of Advertising," commended the Salt Lake public utilites, particularly the telephone company and the Utah Light & Railway Company on the progressive advertising policy which they were pursuing. As an illustration of timeliness in advertising, he threw on the screen a slide of an advertisement run by the Utah Light & Railway Company the day following the attempt of the black hand gang in Ogden to blow up the residence of David Eccles by planting a dynamite bomb under the front porch. The advertisement depicted a front porch light thrown on and a suspicious looking character slinking away into the bushes to escape the light, and was headed, "Burglars and Blackhanders Shun the Light." The reading matter pointed out how this attempt to destroy life and property could have been avoided by the regular burning of a porch light each night.

TRANSMISSION.

MONETA, CAL.—The Southern California Edison Company has purchased a lot at Western avenue and Gladstone street, for the establishment of a substation to facilitate handling of high tension current passing along Western avenue, and to establish a distributing station.

SANTA MONICA, CAL.—In the development work and ultimately for all domestic purposes, electricity will be the only power used in the new 20,000 acre residence tract at Santa Monica Park. Thirty-five miles of road are to be built.

MOAB, UTAH.—Messrs. C. A. Hammond of this city and Joseph W. Christensen of Fairview, have under consideration the installation of an electric lighting plant in this city. A. V. Richards, of the engineering firm of Caldwell and Richards of Salt Lake City, has been in Moab for the past week for the purpose of making an estimate of the cost to install a plant. Mr. Richards has also made preliminary surveys and estimates for the installation of a plant at Monticello.

CHICO, CAL.—Paying the $16,000 more than the price of the option it held three years ago, but allowed to lapse, the Great Western Power Company has settled with Jacob Moak, a pioneer Chico and Plumas county stockman, for $36,000 for his 160 acre ranch at Big Meadows, which is now covered with water. This ranch is the last piece of land bought by the company on the 26,000 acre tract covered by its great natural reservoir which recently was filled with water.

FALL RIVER MILLS, CAL.—The California Power & Manufacturing Company, which recently bought the local electric power plant and obtained a franchise for developing power also from water in Hat Creek, announces that it expects to be able to serve electric current for all purposes to consumers in Fall River Valley by July 1st. Plans have been accepted for the new power plant that will be located

near Pit River, just below the Florin flour mill. A large number of contracts for electric power have been signed up. A power line to Greenburn is almost completed.

VISALIA, CAL.—Formal acceptance by the state officials of the new boundary between Fresno and Tulare counties, as established recently by a joint survey, removes the final obstacle to a suit which the district attorney has been instructed to bring against the Pacific Light & Power Company to compel them to make certain changes in the construction of their transmission lines through this county. It is claimed that the corporation, in building this line, which extends from Crane Valley to Los Angeles, violated the regulations with regard to height of towers and distance these towers are spaced.

BISHOP, CAL.—General Manager Chappelle and Chief Engineer Poole, of the Nevada-California and allied companies, was here recently on a brief inspection of power affairs. Mr. Chappelle stated that the company's present intention is to begin work on Plant 1, on Bishop Creek, this year. It is not expected that the undertaking can be finished before next fall's snows come, but much of the heaviest construction work will have been accomplished by that time. This plant will be the largest of all on the stream. It will contain but one unit, but that will be of 10,000 kw. units in power, as compared with the 2200 kw. units in groups in the other plants. The first intention was to build another plant, A, still further up, but the decision has been reached to concentrate the outlay in plant 1. Its location will be at the intake. Flow lines will come from South Lake and Sabrina, with great fall, each line discharging against its own separate wheel but both connected to the same big generator.

SPOKANE, WASH.—The Washington Water Power Company has purchased the power transmission lines of the Lewiston-Clarkston Improvement Company from Leon Station, Nez Perce County, Idaho, to Moscow, Pullman, Uniontown, Genesee and Colton. The lines were contructed by the Lewiston-Clarkston Improvement Company ten years ago to supply power at wholesale to the local distributing systems of the towns mentioned. The local lines in Uniontown, Moscow, Genesee and Pullman were originally owned by the Shields-McGowan interests of Moscow, and were purchased last summer by the Washington Water Power Company. Since the sale was made the Lewiston-Clarkston Improvement Company has continued to furnish power for the local systems in the towns referred to and will continue the service until the Washington Water Power Company can complete the extensions necessary to enable it to serve the territory, probably on or about June 1. Surveys have been made to Troy, Kendrick and Julietta and it is likely that a line will be built into that territory.

TRANSPORTATION.

PORTLAND, ORE.—The Pacific Power & Light Company will start construction at once of an extension of local car lines around Smith's point to Hammond Mill, Astoria, Oregon. T. W. Talbot of Portland, is president of this company.

MILWAUKEE, WASH.—Louis H. Campbell, a civil engineer of this city, has applied to the council for a 25 year street railway franchise over practically every improved street in the town between the downtown district and the eastern town limits.

LOS ANGELES, CAL.—For the purpose of determining rights of the Pacific Electric and other railroad companies within the city to spur track privileges under franchises for main lines granted by the county before the districts become annexed to the city, the board of utilities has requested the city attorney to bring suit in case of the Simons Brick Company's spur.

VALLEJO, CAL.—The Northern Electric Railway Company is preparing to resume operations in this city. It is announced that a large quantity of ties and rails are to be shipped here during the present month and that a track laying machine will be brought here and used in laying the tracks north from this city. The grading operations in the cut have been completed for several weeks.

SAN FRANCISCO, CAL.—The board of works has awarded to Eaton & Smith the contract for building the Potrero avenue municipal railway line for $143,767. The construction of the track and conduits is to be completed within 120 days from the date of signing the contract. By finishing ahead of the time allowed, the contractors can earn a bonus of $400 a day for 30 days. It is expected the line will be ready for operation toward the end of August or early in September, when the running of cars on the Van Ness avenue line, with which it will connect, is to begin.

DIXON, CAL.—The Sacramento Valley Electric Railway Company has begun laying rails from the Oakland & Antioch junction, 12 miles southeast of here, toward Dixon. Only half a mile of rails can be laid before a temporary halt will have to be made while a bridge 345 ft. long is constructed. The piling for the bridge will be hauled over this half mile of track. Grading to Dixon will he finished within two weeks, is the word of General Manager Melville Dozier. The road will be in operation in July, he says, between the Junction and Dixon. Dozier has been made consulting engineer of the Oakland & Antioch.

SAN FRANCISCO, CAL.—Bids for the construction of the Potrero avenue municipal railway line, which will connect with the Van Ness avenue line at Market street, and will run along Eleventh street and Potrero avenue to Twenty-fifth street, have been opened by the board of public works. The lowest of the five was filed by a new firm of contractors, consisting of Clarence B. Eaton and James Smith, former employes of the public works department. The figuring was close, the firms and their bids being as follows: Eaton & Smith, $134,767.80; Mahoney Bros., $137,432.80; R. C. Storrie, $138,474.50; F. Rolandi, $145,476.50; Healy m Tibbitts, $151,-310. The city engineer's estimate, including a possible bonus of $9,000 for the work, was $142,200.

SAN FRANCISCO, CAL.—At the annual meeting of the United Railways Investment Company, the holding corporation for the United Railroads of San Francisco, Patrick Calhoun, George E. Shaw and Sydney H. March resigned as directors, their places being filled by the election of Alexander J. Hemphill, W. H. Chesebrough and H. J. Miller. There was prolonged discussion accompanied by many objections and suggested amendments to the plan of reorganization of the company. After three hours of argument, a resolution contemplated under the plan providing for the creation of an agency of nine members of either effecting the plan or making such modifications of it as it deemed necessary was passed by the stockholders, with a vote of 143,396 common shares and 81,398 preferred shares.

SAN MATEO, CAL.—The plans of San Mateo citizens to build their own electric line down the peninsula were brought another step nearer consummation when the articles of incorporation of the San Francisco-San Mateo Right of Way Company were adopted. The company is organized to secure a right of way for an electric line from San Francisco to peninsula points which will either be sold to a railroad company to build a system or retained for the people's own electric line. The following directorate has been elected: M. R. Johnson of Montara, president of the San Mateo County Development Association; H. C. Tuchsen, trustee of Redwood City; Torrence Masterson, trustee of San Mateo; D. G. Doubleday of Millbrae; F. A. Cunningham, ex-Mayor of South San Francisco; E. M. Moores, mayor of Burlingame, Rev. W. A. Brewer, mayor of Hillsborough.

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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VOL. XXXII NO. 21 | SAN FRANCISCO, MAY 23, 1914 | PER COPY, 25 CENTS

RESUME OF DIESEL MOTOR INSTALLATIONS.
BY L. R. JORGENSEN.

FAIR EXHIBITS ELECTRICAL.

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BY J. C. HOBRECHT.

CO-OPERATION.
BY W. E. OLIVER.

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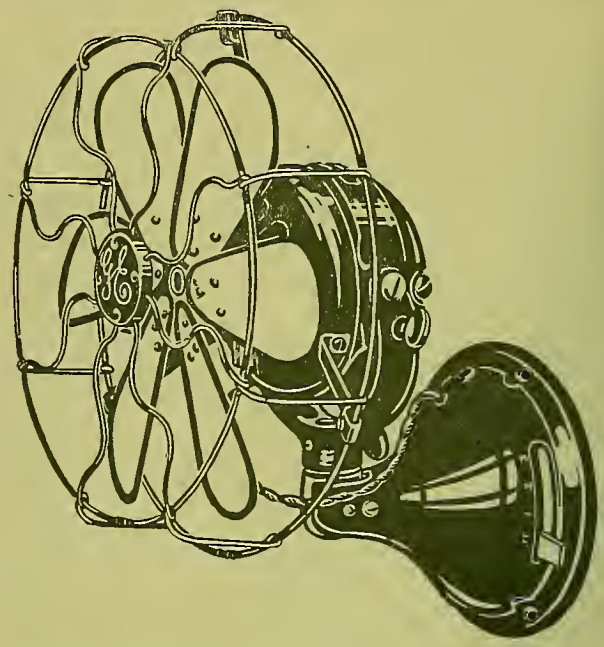
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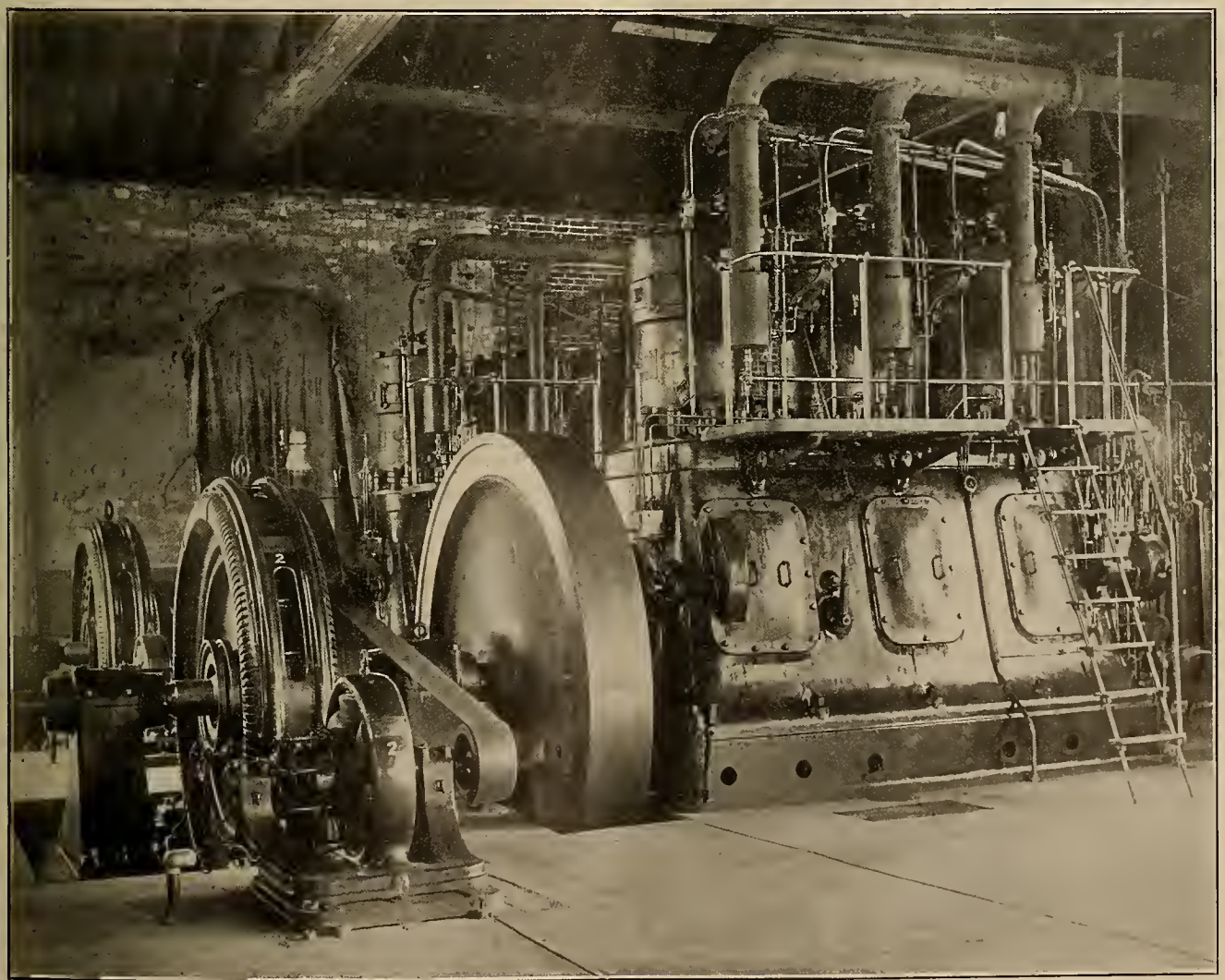
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RESUMÉ OF DIESEL MOTOR INSTALLATIONS

BY L. R. JORGENSEN.

(This article covers the possibilities and present limitations of the Diesel motor. The period over which development has occurred is stated, also the fundamental principles of operation upon which efficiency is based; design is then discussed with reference to particular installations and comparative data given. This paper was presented before San Francisco Section, A. I. E. E., on May 22, 1914, by Mr. Jorgensen, who is designing engineer with F. G. Baum & Company, San Francisco.—The Editors.)

To the electrical engineer the development of the Diesel motor is of interest, inasmuch as it may prove to be a competitor of the steam turbine for large central station work in the future. It is not the fault of the principles upon which this motor works that it is not already delivering the goods there, but because with present oil prices it does not pay and also on account of the inability to produce materials that will stand the high temperature without cracking. This material may or may not be produced in the future, but why should it not? It has been shown in practice that cast iron cylinders will stand the required high temperature at which it is economical to work. For large size cylinders, however, it is not possible to



Two 225 h.p. Busch-Sulzer Bros. Diesel Engines Direct Connected to A. C. Generators.

conduct the heat away fast enough to avoid a dangerous rise in temperature, and therefore the cylinders cannot be made very large. For a large power output many cylinders would therefore be required. This is the main drawback to this type of engine at the present time.

Diesel constructed his first experimental engine at Augsburg, Germany, in 1893, and his first reliable engine in 1897. Progress was slow. Some of the first and most important improvements were the additions of the air spraying pump and the cylinder water

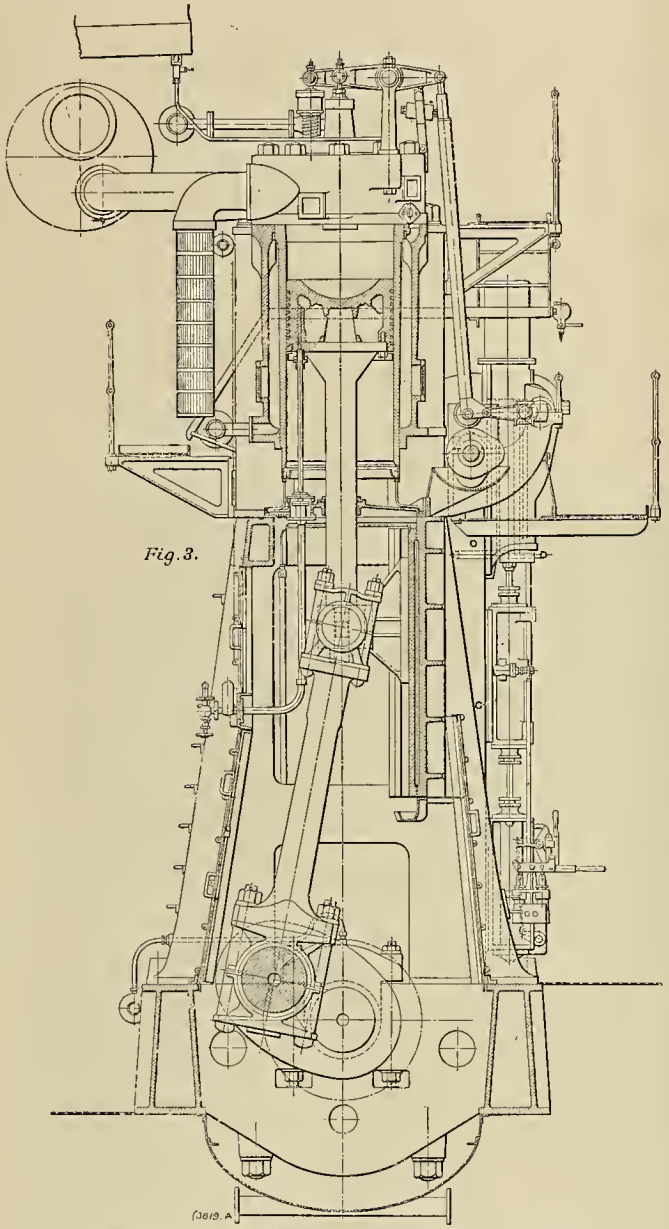
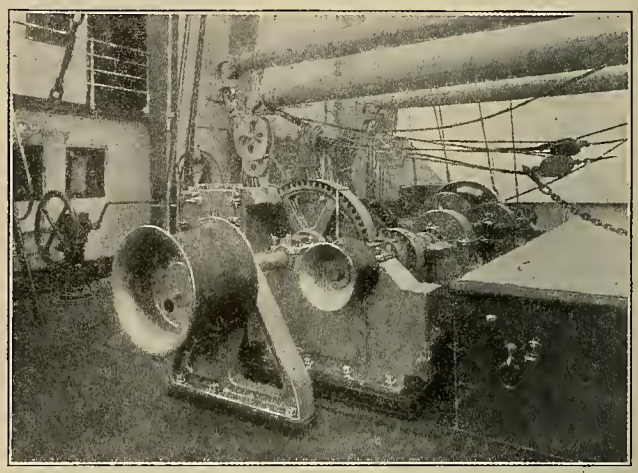


Fig. 3.

Cross Section of 2100 h.p. Diesel Engine Installed in Motor-Ship "Fionia."

jackets. It was found that atomizing the oil as it was injected into the cylinder assisted combustion materially, thereby increasing the efficiency. Good commercial engines have been on the market, especially in Germany, since 1900, and in the last few years the yearly production has increased immensely all over Europe. Mr. Diesel has often stated that his principle is especially suitable for an engine using two strokes to complete the cycle, because the scavenging is not done with a fuel air mixture, but with pure air, so that not only premature ignition, but also fuel losses, are avoided, and the scavenging can be done very effectively. So far, however, the four-cycle principle has come into most extensive use. This principle works as follows:

During the downstroke of the piston, atmospheric air is sucked into the cylinder and on the return stroke this air is compressed to between 500 and 600 lb. per sq. in. The temperature (about 1000 degrees F.) due to this compression is high enough to ignite the atomized oil, which is forced into the cylinder at the end of the compression stroke. This oil burns slowly



Electric-Driven Hoist on Motor-Ship "Siam."

in the cylinder, keeping the pressure constant between 500 and 600 lb. per sq. in. until the admission valve closes and the expansion commences. At the end of the stroke the exhaust valve opens and during the return stroke all gases are expelled from the cylinder and the cycle is completed. The four-stroke cycle engine has a better combustion and 15 to 20 per cent less fuel consumption than the two-stroke cycle engine. Some engineers are doubtful whether this supremacy will last much longer, and think the two-stroke cycle engine with its smaller cylinders will come into favor soon. At several large German works experiments are being made on double-acting two-cycle engines where as high as 2500 h.p. per cylinder has been obtained. At the present time, however, such large output per cylinder is not a commercial reality.

To determine the dimensions of any size engine the value of the most economical mean effective pressure is of particular interest to the designer. To illustrate the significance of this factor let p_m = mean effective pressure, **A** = area of piston, **S** = piston speed. Then indicated power = p_m **A S**.

It follows that if the piston speed **S** is selected, the product p_m**A** is a constant for a given power developed. Thus the higher the value of p_m the smaller will be the necessary value of **A**, and therefore the smaller the cost of the engine. Therefore, the designer would desire to adopt the highest possible mean effective pressure at normal load of the engine, consistent with reliability and with the fulfilling of any guarantee as to capacity for overload without an excessive sacrifice of economy. Actual test has shown that the economy varies but little for p_m — between 80 lb. and 110 lb. per sq. in. It is not desirable to attempt to obtain a mean effective pressure beyond 110 lb. per sq. in., as the

excess of air for combustion in the cylinder is then comparatively small and sufficient cooling of large cylinders and valves becomes a difficult problem. The following approximate calculations illustrate the magnitude of the excess air for combustion:

Cylinder diameter, 12 in.; stroke, 18.25 in.; p_m (mean effective pressure) = 110 lb. per sq. in.; r. p. m., 200; indicated h.p., 57.3; brake h.p., about 40; oil used per cycle, 0.00314 lb. (* "The Engineer," April 11, 1913); air temperature at the beginning of compression, say 120° F.; air theoretically necessary per pound of oil, about 14.6 lb.; volume of air per pound of air at 120° F. and atmospheric pressure, 14.6 cu. ft.; volume swept by piston per stroke, 1.2 cu. ft.; weight of air taken in per cycle $\frac{1.2}{14.6} = 0.082$ lb.

Then ratio

$$\frac{\text{air supplied}}{\text{air theoretically necessary}} = \frac{0.082}{0.00314 \times 14.6} = 1.79$$

This ratio would be unity when enough oil was supplied to raise p_m to 140 lb., assuming that all the oil would find all the air there was present. From this it follows that the probable highest limit of mean effective pressure is below 140 lb. per sq. in. on the Diesel cycle. When for maximum power p_m is chosen

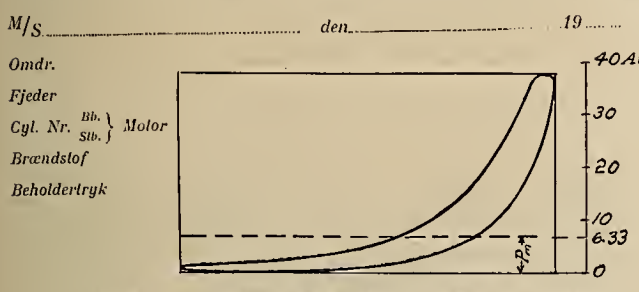


Diagram of Diesel Engine Cylinder of "Siam" During Normal Operation.

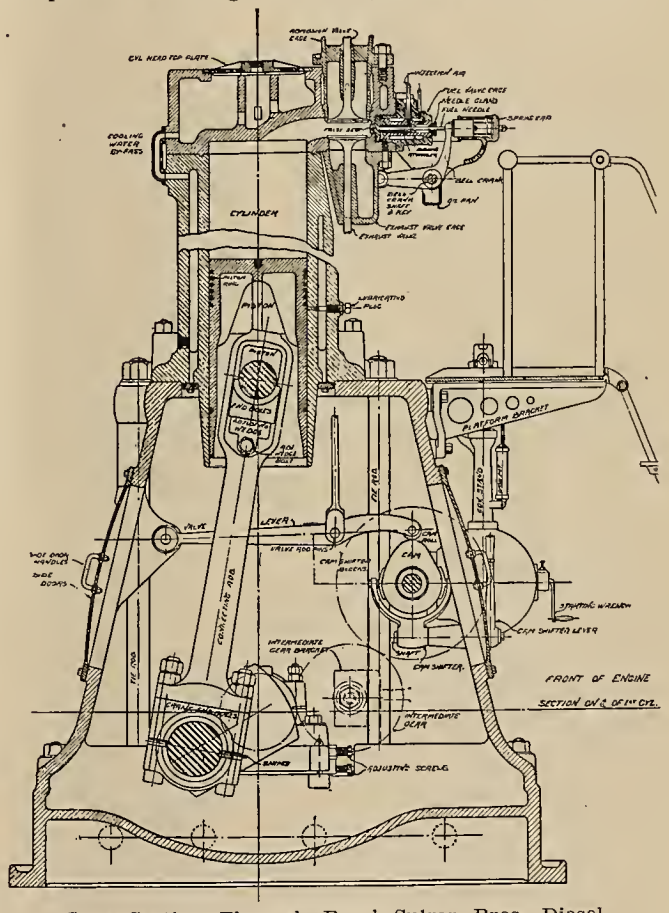
110 lb. per sq. in., the engine will work with a high efficiency over a wide range of power output below this maximum. It can develop more power than this assumed maximum (up to that corresponding $p_m = 140$ lb. per sq. in.), but not so economical.

At present the Diesel engine is in successful operation in many central stations of medium size abroad, and in many industrial plants. It is used to quite an extent for ship propulsion, and in this particular field it is very promising. During the early part of January the largest vessel so far equipped with Diesel engines unloaded freight in the San Francisco harbor, and several local engineers inspected the new machinery. The general opinion concerning the success of this kind of prime mover was favorable. Among those local engineers who made the trip across the bay in the engine room of the Siam no one afterward doubted the maneuvering abilities and reliability of these engines.

The Siam belongs to the East Asiatic Steamship Company of Copenhagen, and was built by Burmeister & Wain of Copenhagen. It is 410 ft. long, 55 ft. wide and the draft is 27½ ft. when carrying 9400 tons of cargo. Each of its two main engines are provided with eight cylinders 590 millimeters (23.23 in.) in diameter and 800 millimeters (31.496 in.) stroke. In good weather this ship makes 12 knots per hour, and in bad weather 10 knots per hour at an engine speed of 125 to 130 r.p.m. Each engine is of 1600 indicated horsepower capacity, and looks much the same as an ordinary steam engine in all its parts except the valve gear.

Each cylinder is provided with one exhaust and one suction valve exactly alike and mounted symmetrically with respect to the centerline. Between these two the starting air valve and the oil spray injection valves are located. The starting air valve is only in use during about two revolutions of the engine, and is cut out automatically during the normal operation of the engine.

In the space just back of the oil valve, the oil is mixed with air in much the same way as steam and oil are mixed for oil burning purposes under boilers. When the valve opens the mixture is injected into the cylinders under a pressure of about 60 atmospheres against the maximum compression pressure of 38 atmospheres existing in the cylinders. The mixture



Cross-Section Through Busch-Sulzer Bros. Diesel Engine.

now burns, keeping the pressure constant at 38 atmospheres until the oil valve closes and the expansion commences. In Fig. 1 is shown a diagram taken from one of the engine cylinders of the Siam during normal operation. The mean effective pressure, as measured, is 6.333 atmospheres, or 93 lb. per sq. in. Keeping in mind that the piston gets an impulse only every other time it is going down, the indicated horsepower from from one cylinder can be found thus:

$$93 \times \frac{\pi \times 23.23^2}{4} \times \frac{31.496}{12 \times 550} \times \frac{127}{60 \times 2} = 195 \text{ h. p.}$$

Each cylinder is supposed to normally indicate 200 h.p. It may be that the engine is supposed to

make more than 127 r.p.m., or that the card in Fig. 1 is not quite a normal one. It is seen that, if the normal indicated output of one cylinder is about 200 h.p., with $p_m = 93$ lb. per sq. in., this engine has a large overload capacity, as it is possible to raise p_m to 140 lb. per sq. in. by injecting more oil. This fact is also taken advantage of when starting the engines; enough oil can be injected to make them come to overspeed in an instant.

When the signal for starting is received in the engine room a small turbine operated by compressed air at 20 atmospheres is started one way or the other. This moves the cam shaft lengthwise about 1½ in., whereby the proper cams for either forward or back operation comes into working. This consumes about 5 seconds time, but could probably be done faster if required. Then air at 20 atmospheres is admitted to the main cylinders and the engine begins to revolve. After making about two revolutions on air the oil is admitted and the air gradually cut out. The oil supply is rapidly increased and in about 5 seconds the engines are running at the rate of about 200 r.p.m. This speed is kept up for a short time only, and the operating lever is thrown back to normal position, at which position the engines work most efficiently. When the engines are stopped, the small air turbine is made to move the cam shaft in the middle position. This is done for two reasons: First, that as the engineers do not know whether the next order will be forward or back, they put the cam in such a position that it will take an equally long time to throw it either in the forward or back position; and secondly, when the cam shaft is set in the intermediate position a small device opens all the exhaust valves to free all the cylinders from whatever charge they may contain. This prevents any premature explosion that otherwise might accidentally take place when the engines were again started.

The oil pump for injecting the oil into the cylinders is connected to the main engine through a gear, there being one pump for each four cylinders. This pump is fed by gravity and raises the pressure to the usual injection pressure of 62 atmospheres, though this varies from 60 atmospheres to 100 atmospheres, depending upon the viscosity of the oil. At 100 atmospheres the safety valve blows, indicating that the oil is too thick to be forced through the spray openings of the valve. The amount of oil is regulated by keeping the "suction" valve open for a longer or shorter space of time. The amount of oil and the amount of air for atomizing this oil are changed together on the main engines in such a way that no air is being wasted, the pressure of this air being 60 atmospheres.

On the two auxiliary engines of 250 indicated horsepower each, the air supply is constant and the governor only varies the oil supply according to the load. These two auxiliary motors each drive a d.c. generator when the ship is lying still loading and unloading cargo (all the hoists are electrically driven), and a compressor when out at sea. This compressor raises the air pressure from atmosphere to 20 atmospheres, and sends the air into a large storage tank, or into another air compressor where the air pressure is raised to 60 atmospheres. This last compressor is connected directly to the propeller shaft and furnishes the air for atomizing the oil injected into the cylinders.

Of other important auxiliaries in the engine room on board the Siam, the most important are the electrically driven pumps for pumping the fuel oil from the different compartments in the double bottom of the ship up into two fuel oil tanks (each tank sufficient for a 12-hour run) located some 30 feet above the pump feeding the oil to the cylinders. This of course is to insure a gravity flow to this latter pump. Then there is also a small auxiliary compressor, and a small generating set for lights. A small oil burning boiler is also located in the engine room for making steam for heating purposes.

In the double bottom of the ship, and in other places that cannot be put to any use, 1250 tons of oil can be stored. As the ship uses 10 tons of oil per day when at sea, it is able to carry fuel enough for a 125-day run, or 33,000 nautical miles. A ship with this engine capacity would require 50 tons of coal, or 30 to 33 tons of oil a day if provided with steam engines and boilers. The Siam can carry 1000 tons more weight, and much more than 1000 tons by measurement, than a ship of similar displacement provided with steam engines.

If 10 tons of oil is used in 24 hours, then 833 lb. are used in one hour, and the consumption per indicated horsepower would be $\frac{833}{3200} = 0.26$ lb., assuming one of the auxiliary and the two main motors to indicate 3200 h.p. altogether. Per brake horsepower this consumption would be approximately 0.34 to 0.36 lb. No accurate tests have been made as to consumption per brake horsepower, as the average ship-owner does not care so much for such figures. He is, as a rule, more interested in knowing the consumption of coal or oil fuel per diem in connection with dead weight and speed maintained. These figures define the fuel bill, which he is anxious to keep as low as possible, so that his ship may make a favorable showing in comparison with his competitors.

An interesting practical test has been made with the British ship S. S. Conch. From a number of voyages of this ship with the boilers burning either coal (14,500 B.t.u.) or oil (19,000 B.t.u.) and the engines kept running as nearly as possible in the same condition as regards vacuum, revolutions, etc., it was found that the ship carrying a dead weight of about 7700 tons would use 22½ tons of oil per day against 32 to 33 tons of Welsh coal, or a mean saving by weight in fuel consumption of 33 per cent. As a direct consequence of this, it was found the ship carried 150 to 200 tons more cargo when burning oil under the boilers. The indicated horsepower in both cases was close to 1670, although on the average, perhaps less when using coal. With regard to the speed attained by the ship, it was found that this was much better maintained by the oil-fired steamer. This was mainly attributed to dispensing with the cleaning of fires, and also to the fact that in the tropics it is hard to maintain full pressures on the boilers using coal. In reality the ship made one knot more per hour when oil was used for firing than it did when using coal under the boilers.

In comparing the enormous advantages derivable from oil fuel in connection with Diesel engine ships

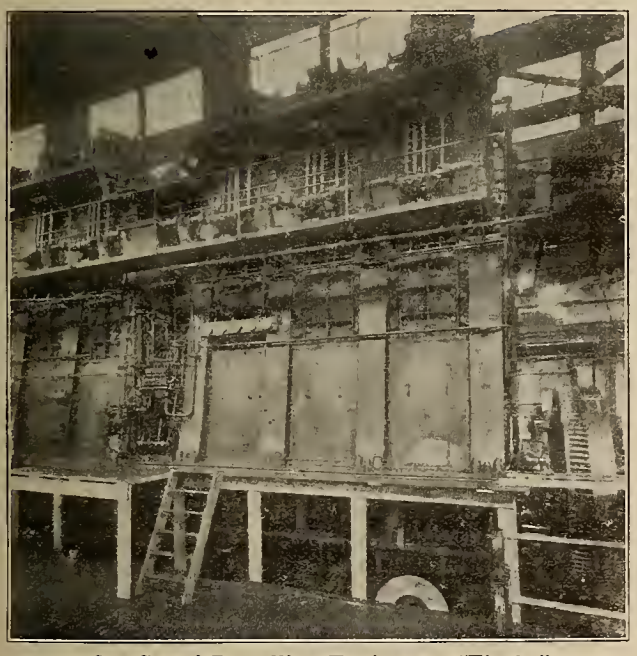
with the use of coal in ordinary steamers, the following figures obtained in actual working, the mean result of two years' running, may be found of interest.

Comparison between motor vessel Vulcanus, belonging to the Anglo-Saxon Petroleum Company, which commenced service in February, 1911, and a steamer of slightly less carrying capacity:

S. S. Vulcanus—	S. S. Sabine—
Length .....196 feet	200 feet
Breadth .....37 feet 9 inches	30 feet 6 inches
Draught .....12 feet 4½ inches	16 feet 9 inches
Dead weight carrying capacity..1235 tons	1269 tons
Displacement .....2080 tons	2290 tons
Mean speed.....8 knots	8 knots
Consumption per 24 hours.....2 tons oil	11 tons coal
Total No. staff and crew (European)....16	(Chinese) 30

The Burmeister & Wain Company of Copenhagen is at present building two large ships exactly alike, except that one is provided with a steam engine, and the other with Diesel motors. Comparative tests will be made by the owners of the ships, to find out to what degree it pays to remove the steam plant in existing steamers and put in Diesel motors.

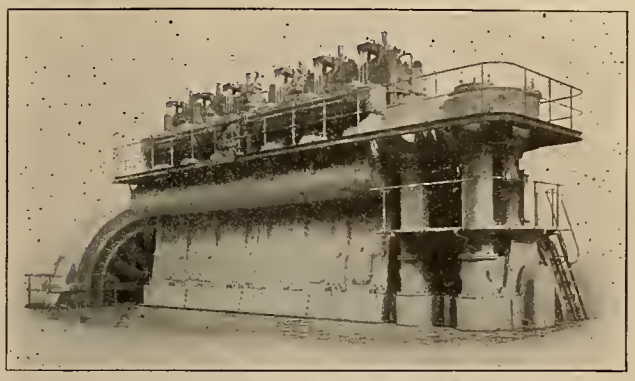
In February, 1912, the first Diesel ship, Selandia, left Copenhagen for East India. It had a carrying capacity of 7400 tons and its two motors indicated 2500 h.p. This was the trial boat. It worked admirably well, but it was found of advantage to make some changes in valve material and other changes. These changes decreased the oil consumption from 10 tons a day to about 8 tons.



One Set of Propelling Engines on "Fionia."

Two more ships like this first one were built for the East-Asiatic Steamship Company. Then a year later the Siam made its maiden voyage to Siam and back again, and then started on a trip around the world.

When the Siam arrived at San Francisco, it had motored 40,000 miles. During that time none of the main bearings had been scraped. This was, however, going to be done in the next harbor. The valves had been ground a few times while the ship was lying still in some harbor. This was done by the ship's own force. One valve broke at sea, being the only mishap on the 40,000-mile trip. It took 16 minutes to replace it. A valve does not break down without warning. It first becomes leaky, and for the purpose of detecting a leaky valve trial cocks are provided in proper places on the cylinders. When the leak becomes so bad that the



4000 h.p. Sulzer Diesel Two-Cycle Motor.

compression is lost, the power impulses of the corresponding cylinder is lost, and therefore the valve is changed as soon as the leak is detected, if possible.

The latest ship of the East Asiatic Steamship Company is the motor ship, the Fionia, a combination freight and passenger boat of nearly the same dimensions as the Siam, being 400 ft. long, 53 ft. breadth, and capable of carrying 7000 tons dead weight.

The propelling machinery, however, is larger, having an indicated horsepower capacity of 2100 for each of the two engines.

The advance of the art permitted this power to be generated in a six-cylinder engine, making it 350h.p. per cylinder, as against 200 h.p. for the Siam. The power plant in this ship occupies two-thirds of the space of a corresponding steam plant, and weighs 40 per cent less.

During the P. P. I. Exposition the Fionia is to run in passenger service between Copenhagen and San Francisco, but ordinarily it will run between Copenhagen and East India. At present it is on its maiden voyage to there.

The Fionia is expected to maintain a speed of a little above 14 knots. Its cylinder dimensions are as follows: Diameter, 740 m/m. (29.1 in.); stroke, 1100 m/m. (43.3 in.).

For cooling purposes the salt sea water is used. The propellers are normally making 100 r.p.m.

On land, where a motor only needs to be able to run in one direction, there is of course much less difficulty in successfully constructing them, and therefore much attention has not been paid to them in this article.

The accompanying view shows a 3000 kw. generator, driven by a 4000 h.p. two-cycle Diesel motor made by Sulzer Bros. in Switzerland. The view of the two 225 h.p. engines, made by the Busch Sulzer Bros. Diesel Engine Company, in St. Louis, is an American installation.

The standing of the Diesel engine in this country today is about the same as the standing of the steam turbine was twelve years ago. Whether it will be put into extensive use here will largely depend upon the desire of some large companies to take up its manufacture, which they will surely see fit to do, should fuel oil double in price.

SELLING ELECTRIC SERVICE

FAIR EXHIBITS ELECTRICAL.

(This is a description of an electrical exhibit for fairs as installed by the Pacific Light & Power Company and described in the Manager's Bulletin of that company. The apparatus exhibited is fully detailed and results showing the prospects secured also given.—The Editors.)

"Electricity on the Farm" was the feature of the Pacific Light & Power Company's exhibit at the Walla Walla County Fair and the Washington State Fair at North Yakima. The purpose of this exhibit was to show the many uses to which electricity could be applied on the farm, particularly emphasizing the use of a motor. To do this, nearly every type of farm machinery was installed and operated electrically, from incubators and milking machines down to the many household appliances. The exhibit was held in a large tent 30x100 ft. At the entrance of the tent were booths rented to local supply houses and dealers. In the center of the tent was the machinery exhibit and at the far end, a "modern farm house."



Night View of the Fair.

The Machinery Exhibit occupied a space in the center of the tent 18x35 ft. and railed off. Electrically driven farm machinery was set up, the illustrations showing the general arrangement of machines and method of installation.

The exhibits were as follows:

"Fork" Hay Hoist.—Manufactured by the Gilbert Hunt Company of Walla Walla, Wash. Double drum; price $275. This price only includes the hoist. The track, carriage and fork are separate and are handled by most implement houses. This was operated by a 3 h.p. General Electric motor, belted. Hay was actually hoisted from the ground and carried 25 ft. Then the fork was drawn back. All operated by one man seated on the hoist.

Roller Mill.—Manufactured by the Gilbert Hunt Company, Walla Walla, Wash. Operated by 1 h.p. General Electric motor. Machine operation—600 r.p.m. Oats were put through this mill, thus giving an actual demonstration.

Fanning Mill.— Walla Walla—handled by Tierney-Toner Company. North Yakima —handled by Yakima Implement Company. Machine operates at 70 r.p.m., driven from counter shaft. A fanning mill is used to clean all different kinds of grain and generally sells for about $40.

Apple Wiping Machine.—Manufactured by Enterprise Fruit Machine Company, Zillah, Wash. Sells for $110 at Zillah. Driven from counter shaft. Machine speed 125 r.p.m. (Requires 1 h.p. to operate.)

This machine is most satisfactory, and the fruit is cleaned thoroughly without any damage. At present there are about forty of these in use in the Yakima Valley and several at Hood River, Oregon. The Davidson Packing Company, foremost packers at Hood River, use this machine entirely for cleaning fruit. During the exhibit apples were run through the machine and a great deal of interest was created.

Milking Machine.—Manufactured by the Sharples Separator Company, branch office at Portland, Oregon. Operated by a 3 h.p. General Electric motor. A counter shaft was used to secure a reduction in the speed from 1800 r.p.m. to 80 r.p.m. required at the vacuum pump.

At Walla Walla, a Sharples Cream Separator was operated from this counter shaft by using a governor but at North Yakima, a direct drive was adopted.

Every afternoon at 4:30 during the Walla Walla exhibit, three cows were milked in an enclosure just outside of the main tent. Crowds were present every day.

Alfalfa Cutter.—Walla Walla—handled by Walla Walla Implement Company. Machine—"Ohio No. 9."

North Yakima —by Yakima Implement Company, Machine "Ohio No. 9."

Driven by 1 h.p. General Electric motor at 500 r.p.m.

Wood Saw.—Manufactured by Gilbert Hunt Company, Walla Walla, Wash. Belted to 1 h.p. General Electric motor, operated at 600 r.p.m.

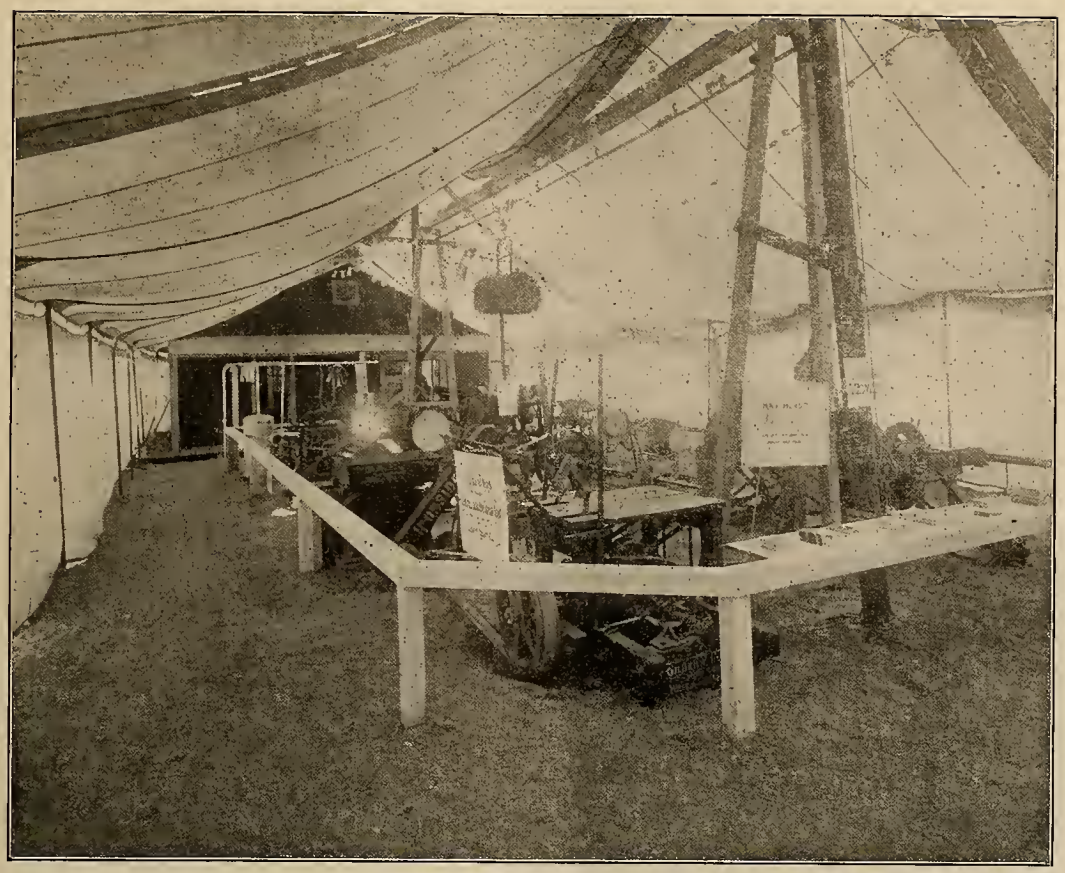
Ice Cream Freezer, Cider Press, Grind Stone, Barrel Churn.—All these machines were operated from countershaft, driven by 3 h.p. General Electric motor, 1200 r.p.m.—speed of counter shaft was 225 r.p.m.—speed of machines reduced to between 50-75 r.p.m.

Besides these, the apple wiping machine, fanning mill and power washing machine were driven by the same counter shaft. Great interest was created by this shaft drive and the women particularly were impressed at the convenience and labor saving value of a motor to drive these small machines commonly used around the farm house. The installation was especially an example of what a pump motor could be used for after the irrigation season.

The Cider Mill was also operated and cider served free to any person visiting the exhibit.

Ensilage Cutter.—Walla Walla—handled by the Walla Walla Implement Company. Type of machine—"Silberzahn."

North Yakima—handled by Yakima Implement Company; "Ohio No. 15," operated by 3 h.p. General Electric motor, belt drive.



Machinery Exhibit With "Modern Farm House" in Background.

The Modern Farm House.—At the rear of the tent "The Modern Farm House" stood as a model on an electric home. It consisted of two rooms, one a sitting room and the other a dining room, equipped throughout with electrical appliances and devices. Vacuum cleaner, electric fan, Copeman range and all other household appliances were demonstrated here. Coffee and toast were served and music helped to make it a pleasant rest room for "Fair" visitors.

At North Yakima particularly it was the popular resort and there was hardly an hour in the day when it was not filled.

At Walla Walla, the Valley Electric Supply & Fixture Company, and Prince Electric Company had booths, and in addition Freuler & Dyer showed the Perry Domestic Water System. The Ohio Vacuum Cleaner also had a booth and the Pacific Power & Light Company had additional space where a complete line of incubators were exhibited.

At North Yakima these exhibits of dealers were a great addition to the show. Not only did they bring out forcibly the value of the appliances through the capable sales force of these different concerns but they created an interest in the exhibit among the city people as well as the ranchers.

Beside the regular sales force of the company, representatives of the Westinghouse and General Electric Companies were present, giving most able assistance and their efforts were devoted not only to making sales and securing prospects but helped greatly in keeping up the enthusiasm which is necessary to make an exhibit of this nature successful.

It is always difficult to definitely state whether an advertising proposition such as this is successful or not, but as near as can be determined from the prospects secured and interest created, "Electricity on the Farm" exhibit this year did a lot of good.

At North Yakima, the following prospects were secured:

Incubator .....21 prospects
Domestic Water System..... 38 prospects

In addition, several plants were sold outright. (One installation is to be shipped to Switzerland and while this does not help to increase our business, still it shows the actual results brought to the exhibitor.)

Apple Wiping Machines.....90 prospects
Milking Machine .....10 sure sales and about 40 good prospects. The exhibit plant was sold.
Feed Mill and Ensilage Cutter.....60 prospects

The Ensilage Cutter particularly created interest. In the last year or so a large number of silos have been installed in the Walla Walla and Yakima Valleys and the increase in the stock industry and in the production of corn and alfalfa means that this class of business will grow very rapidly. All prospects were very much interested in the motor drive.

The supply houses secured about 50 prospects on appliances; "The modern farm house," nearly 30 prospects on Copeman Ranges, 25 on Vacuum Cleaners and 44 on general appliances.

Two lighting extensions were lined up, one for 16 customers and one 7 customers, both in the Selah District.

A careful and systematic "follow up" canvas is to be made of all prospects secured and actual business should result. The newspapers were most liberal in their comments of the exhibit and there is no question that "Electricity on the Farm" was one of the feature exhibits at both fairs. The night exhibit was most spectacular, as can be gathered from the illustration. The interior was also a flood of light. Something like 15 kw. was connected for illuminating purposes and about 20 kw. were utilized for power and experimental machines.

P. P. I. E. MACHINERY EXHIBITS

(It is required of all exhibits at the P. P. I. E. that they must be of educational value, and this is especially true of those pertaining to engineering and the allied arts. This new department of Journal service describing the various machinery exhibits, and here inaugurated, will have a dual interest and value, first as news of wide scope and interest, and secondly because of its educational import.—The Editors.)

A DIESEL ENGINE EXHIBIT FIRST.

The installation of the first exhibit at the Panama-Pacific International Exposition on Wednesday, May 27, will be the most important of the ceremonies of the Exposition to date and will mark the completion of the first stage of exposition building—the construction work and the commencement of the second phase of activity, the collection of exhibits from all parts of the world and the placing of them in their respective positions.

The first exhibit will be an immense 500 h.p. Diesel oil-burning engine and will be exhibited by the Busch-Sulzer Diesel Engine Company of St. Louis. The installation will cost $70,000 and will require six months to complete.

The nine principal exhibit palaces will be completed on May 25th and formally accepted by the Exposition from the contractors, and the installation of all classes of exhibits, save fine arts and horticulture, will commence immediately thereafter.

The company manufacturing the Diesel engine commenced the preparation of foundations for the mammoth exhibit on April 1. An appropriate celebration has been arranged by the Exposition for the installation ceremonies and Captain Asher Carter Baker, U. S. N. (retired), Director of Exhibits, will formally start the installation by pulling the lever of an electric pile-driver, which will sink the first pile to support the engine.

Addresses will be made by Captain Baker, Lieutenant George W. Danforth, U. S. N. (retired), Chief of the Department of Machinery, and W. S. Heger of the Busch-Sulzer Diesel Engine Company of St. Louis.

Lieutenant Commander C. H. Woodward, U. S. N., naval aid to President Chas. C. Moore, will deliver an address on "The Value of the Diesel Engine to the U. S. Navy."

That the first exhibit to be installed should be the most recent invention and one vital to California interests, as it will open a new field for the marketing of the crude oil, was deemed especially appropriate. There are several manufactures of the "Diesel" engine, this exhibitor, however, being the only one in the United States.

The ceremony will be held at two o'clock in the Palace of Machinery and will be attended by several hundred engineers of note from all parts of the country, and city and state officials.

U. S. STEEL CORPORATION EXHIBIT.

The announcement is made that the United States Steel Corporation and its subsidiary companies propose to have a comprehensive exhibit of its operations at the Panama-Pacific Exposition in San Francisco, 1915. It will begin with the ore fields and carry on an educational picture of the operation in ore mining, rail and water transportation, dock operations, coal, coke and pig iron production, steel manufacturing in its various lines, the processes of manufacturing of many of its subsidiary companies' products (including "National" tubular and allied products), also the manner in which its by-products, and the display of many of the uses in which its general products are employed, typifying the advancement in the uses of this country's resources.

In addition to the material exhibits, the corporation will exhibit, by moving pictures, its operations throughout all departments showing the ramifications of the processes of the corporation's operations. It is proposed as well, to set forth to the world the work which the United States Steel Corporation has done toward the social welfare of its employees and those depending upon them. Many forms of safety devices will be exhibited that have been conceived by the corporation officials and its employees and in the installation of which large sums have been, and are being expended by the corporation. In this social welfare department will also be shown the methods employed by the corporation in the aid and care for the injured and the welfare of employees' conditions at work and the benefits that are aimed to be afforded to employees at their work and in their surroundings. Also the voice that is given to the employees through their committees in bringing about these improved working conditions and the general plans of the corporation's methods.

OFFICIAL CLASSIFICATION OF EXHIBITS.

Machinery, listed under Department F. Group 85 is as follows:

Steam Generators and Motors Utilizing Steam. Accessory Appliances.

Class 449. Steam engines and steam turbines, portable, semi-portable and stationary; valve gear, governors, lubricating apparatus, and accessories attached.

Class 450. Boilers, stationary, marine, portable and semi-portable; boiler equipment, including furnaces, grate bars, smoke stacks, mechanical stokers, oil burners, oil and other fuel systems, mechanical flue and tube cleaners; forced and natural draft apparatus and equipment; fuel economizers, superheaters; boiler fittings; coal handlers and conveyors; ash handling systems and apparatus.

Note:—Agricultural and road making machinery is not included herewith.

Class 451. Appliances for handling and purifying feed water: feed pumps and injectors, feed water regulators, feed tanks; feed water heaters; chemical and mechanical purifiers, oil extractors, scale removing appliances and compounds; water softening compounds. (See Class 462.)

Class 452. Valve gear, governors and speed regulators for steam engines or turbines, not attached.

Class 453. Equipment for transmission and control of steam: steam piping and piping systems, including pipe, valves, fittings, steam hose, traps, separators and exhaust heads.

(To be continued.)

LIGHTING METHODS

THE LIGHTING OF OUR HOMES.

BY J. C. HOBRECHT.

(In this article which may be considered as introductory to others by the same author, some of the faults found in home lighting are mentioned and an appeal made to fixturemen to operate together in advocating good lighting—which includes lighting fixtures that harmonize with other decorations and furniture.—The Editors.)

The lighting of the home is the one phase of the lighting question where thought and energy expended in improving conditions will, perhaps, be of more real benefit to humanity than any other of the many problems confronting the illuminating engineer.

Many of the ills that human eyes are heir to, can no doubt be traced directly to the faulty illumination of the home. Perhaps in the very first moments that baby eyes are allowed to look upon some of our modern light sources the trouble is begun, to be aggravated later through bad illumination of study or play rooms, the family living rooms, or in fact most any or everywhere from cradle to grave. Faulty illumination enough is encountered to wreck all but the strongest eyes, and if we observe the number of even very young children wearing glasses, we, in the lighting business might ask ourselves whether we are guilty of some of this misery.

I think we will agree that at least a majority of homes are incorrectly lighted and many are simply atrocious. This statement holds true both from the artistic as well as the hygienic viewpoint.

The question then arises, who is responsible for this condition of affairs, and what is the remedy.

When we find a house that is poorly built, having seams and cracks, letting in the rain and weather, with poor ventilation, inconvenient arrangement of rooms, unsanitary plumbing, and an awkward, unsymmetrical exterior, on whom do we place the blame? Without hesitation, we blame the architect.

If a client should come to any reputable architect and ask him to design a house having all the faults just referred to, would he give the client what he asked for or would he refuse to build a house which violated all the principles of art and hygiene? I think the answer is obvious, yet the writer once asked the manager of a large lighting fixture house, why he placed on the market a certain fixture which was both horribly ugly and hopelessly inefficient, and listen to the answer he gave, "It sells." Does he not put himself exactly in the position of the architect who would knowingly and willingly design a house that would be an eyesore, uncomfortable, and a menace to the health of its occupants.

Anyone who will but give the lighting question a little study will see that those responsible for the creation of much of the lighting equipment of our houses are guilty of that very thing every day, and then they try to place the blame upon the unsuspecting laymen who of course does not and cannot be expected to know better.

We can thank the Illuminating Engineering Society for the great work it is doing to remedy this condition, but much remains to be done. To educate the general public directly would of course be attacking the problem from the wrong end, but those interested in the industry and making their living out of it, should, at least, study and be familiar with the principles of "good lighting," if not from a humanitarian or aesthetic viewpoint, then at least with a mercenary one, as it has been demonstrated time and again in many lines that the public is willing to pay for better things and will spend money freely for comfort and service, while the price of a mediocre article is usually paid grudgingly.

There is so much to be said upon this question that it will be impossible in an article of this kind to go deeply into detail. I will, however, enumerate a few of the faults commonly found in residence lighting with the hope to soon be able to give a more specific paper with more concrete examples and suggestions.

A short time ago the writer was in the drawing room of a very wealthy family. The room was most elegantly furnished. The work of an expert decorator was plainly visible in the hangings, wall coverings, pictures, and all the general furnishings but, Oh! the poor unfortunate lighting fixtures. They were about as much in harmony with their surroundings as the proverbial pig in the parlor. A ceiling fixture, a terrible example of the "Mission Craze" of a few years ago, was resplendent in a dressing of French Crystals and its bare tungsten lamps literally burned the eyes out of you, unless you shut them or kept your face to the wall. The writer tried the latter, as there, at least, he found brackets which in other surroundings he could have much admired, as they were really beautiful examples of the Louis XIV period, and the light of the low candle power carbon lamps was, at least, bearable, even if adding but little to the illumination of the room. This was evidently a case where the owner got what he selected, but what should we think of the man who sold it to him. The fixture salesman is often blamed for paying too much attention to the artistic and neglecting the practical side of the question, but in this case the salesman must have been devoid of any semblance of artistic feeling as well as brains.

Another example just the opposite. A dining room with dark tapestry walls and dark woodwork. An indirect fixture, made of composition of rather pleasing design, but hung much too low, throwing its light on an almost while ceiling, leaving the table dark in comparison and giving one rather the impression of being down in a well.

How easily in both of these cases might the lighting have been made a happy addition both to the artistic effect as well as adding to the comfortable occupancy of these rooms and, no doubt, the owners would have gladly accepted suggestions had they only received them. With a little study and thought on the part of the salesman, he could have made these rooms not only a joy to the owner but also a credit and a satisfaction to himself and would possibly have

brought more business to himself or his house in the future.

A doctor may prescribe good pills but if the druggist mixes in the wrong drugs, he will most likely do harm.

The illuminating engineer and the clever designer may work out many correct combinations of "good lighting" and "good taste," but if the fixtureman persists in handing the public the wrong thing, he injures not only the patient but himself and the whole industry as well. Here might be a good chance for that overworked but little heeded word "Co-operation."

If this article would but arouse a ripple of interest among my fellow (I came near saying conspirators) in the lighting business, I will be glad to follow it up and give time and lend whatever assistance I can to any effort to put the industry on a higher plane, to further the interests of correct illumination, especially on the Pacific Coast where but little concerted work has been done along this line.

IN LIGHTING, QUALITY COUNTS.

The effectiveness of lighting glassware is a new viewpoint which necessitates consideration of its fitness for the purpose for which sold.

The average fixture manufacturer or dealer tired long ago of the word "efficiency," for he found that customers' comments were not regarding resultant illumination, but were dependent upon the appeal of appearance to the purchaser's taste.



Fig. 1. Types of Glassware Used in Original. Installation.

Warm (lighted) glassware called forth comments such as "How pretty"; "That is pleasing"; "That is certainly cosy-looking," and so forth. The purchase was made accordingly.

Even now, it is rarely the case that lighting glassware is sold for what it will accomplish, but rather from this viewpoint of appearance.

Individual tastes of purchasers vary widely, taste being of course limited also by the cost of the glassware and the knowledge, or lack of it, on the part of the purchasers as regards the adaptability of the glassware chosen to the fixtures on which it is to be used and its relation to decorations and furnishings of the room in which it is to be installed.

Lighting installations, all other things being equal, should reflect the individuality of the owner of the home.

It would be unfair, however, to even suggest that the majority of home lighting installations actually do this, for there is in general a noticeable lack of harmony between the glassware and the fixture on which it is installed, between the size of the lamp and glassware, and in the general fitness of the ensemble.

There often exists also an unnecessarily low intensity of illumination.

This is due to changes in lamp styles and sizes without purchase of new glassware, and to changes in decoration of rooms and furnishings without consideration being given the lighting fixtures—the finial of the complete scheme of decoration.

Crystal, rough inside (C. R. I.) glassware was valuable only in passing. Though an excellent diffuser for carbon lamps with their yellowish glow, it is of but little value for reducing the brilliancy of present day Mazda lamps.

These are also required to be installed at greater mounting heights, and an assured and efficient control of the light flux is therefor essential. This does not obtain with the C. R. I. glassware, but is possible, and with increased effectiveness, in the lighting by use of more up-to-date lines, such as the ornamental and Sheffield designs in the so-called opal glassware and even with those designs now on the market, which totally enclose the lamp.

By the use of this glassware the brilliancy of the lamp is satisfactorily reduced, illumination values increased and the decorative value of the lighting scheme greatly enhanced.

In his paper on "Lighting of a Simple Home," presented by Mr. A. L. Powell before the Illuminating Engineering Society, he gave some interesting data regarding the C. R. I. glassware displaced, which he has tabulated as follows:

But three varieties of reflecting and diffusing media were used in the original installation. These are shown in Fig. 1, and the vertical distribution of light obtained from each one of them, using a 50-watt, 16.8 c.p. carbon lamp, is shown in Fig. 2.

(A) Square Rough Inside Crystal Glass Shade.

	Per cent.
Total lumens clear bare lamp	100
Total lumens lamp and reflector	86
Downward lumens lamp and reflector	51
Lumens in 0 to 60° zone lamp and reflector	28

(B) Rough Inside Crystal Ball.

	Per cent.
Total lumens clear bare lamp	100
Total lumens lamp and globe	90
Downward lumens lamp and globe	48
Lumens in 0 to 60° zone lamp and globe	24

(C) Imitation Prismatic Crystal Glass Shade.

	Per cent.
Total lumens clear bare lamp	100
Total lumens lamp and reflector	80
Downward lumens lamp and reflector	47
Lumens in 0 to 60° zone lamp and reflector	27

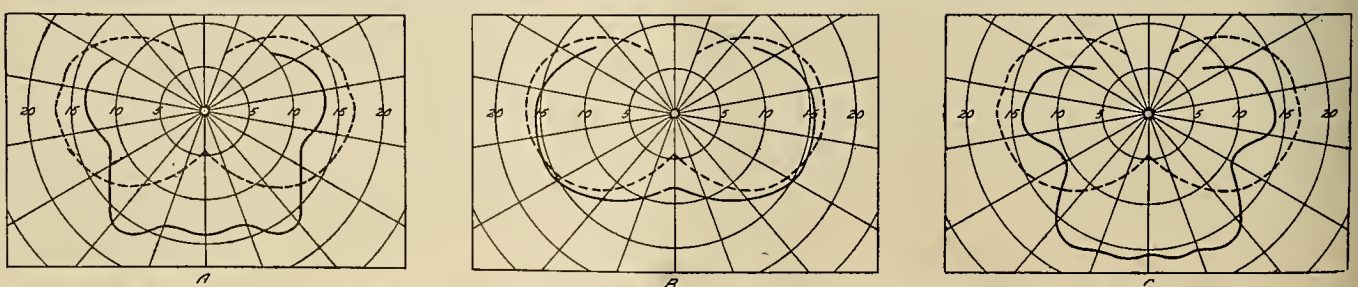


Fig. 2. Photometric Curves of 16.8 c.p., 50-Watt Carbon Lamp Equipped With Glassware Shown in Fig. 1.

From this it will be gathered that the average light flux in the useful zone (approximately 0°—60° in a direct lighting system) was only 25 per cent, which you will notice by comparison with photometric curves and data furnished you by manufacturers, is insignificant compared with that given by quality glassware. Withal the effectiveness of the installation will invariably be greater and quality sales resulting in satisfied customers will exert a strong influence upon improved business conditions in these lines.

It pays to co-operate also with those in occupations allied only remotely with the electrical industry.

Fixture men, for example, should work in co-operation with decorators, and lamp dealers would do well to discuss with purchasers the fitness of the lighting glassware, used by them, especially where it is known that a lamp of larger wattage than heretofore is being purchased.

In this way additional sales are made through service, and the increased business will be found much greater in proportion to the effort expended.

Quality sales should be mentioned in this connection, for they are then more readily made.

It will be found in general, that more artistic, more effective illumination can by but a little study be secured at a lower operating cost. Wherever you are able to demonstrate this—both by past performance and specific analysis—to your prospective customer's satisfaction, you will find that he will be readily converted to the business building truism and belief—In Lighting, Quality Counts.

Use this slogan in the interests of increased business and better business relations.

CO-OPERATION.

BY W. E. OLIVER.

(This paper was read by Mr. Oliver at a meeting of district managers of the Southern California Edison Company.—The Editors.)

The word Co-operation is defined by Webster as the act of operating together or joint operation.

In my opinion good, clean salesmanship is developed by the honest and truthful way in which the business is secured and the psychological moment will arrive according to schedule probably more often did we practice co-operation. Working together for mutual benefit. This is the whole trend of thought today. It means big, broad issues, and these must be met in a big, broad manner. We cannot all be presidents, but, by faithful service, honestly rendered, and a co-operative spirit, we should be able to fit ourselves to any position, either with our own company, or in other walks where our services may be in demand.

We are all salesmen, whether filling the position of meter reader, collector, bookkeeper, head of department, agent, clerk or secretary, for the reason that if we are not directly engaged in selling devices, we are selling that which with the united efforts of all, results in the satisfactory sale of our composite commodity, electric service.

The salesman should at all times co-operate with the customer, fellow employe and employer, and if these three are brought into harmony, you will find that the psychological moment has arrived.

The salesman, co-operating with his department, must find the ways and means of selling the commodity which the company has for disposal. This company, in selling its energy, renders a service which should be continuous, just as it is on our lines. That is, the salesman should keep in touch with the customer after the business is secured. You can do it by co-operation. The salesman should never consider a signed contract for energy or an agreement to take an appliance as a completed sale; rather, it is just the beginning and upon the salesman's representations, his care of the customer and the manner in which he handles the transaction and keeps in touch with all details, he either builds up or tears down the foundation of his company's success.

There should be a perfect understanding between the customer—future or otherwise—the salesman who represents the company and the head of the department as to every detail in question. This department should in turn be in close touch with the construction, connection and trouble departments as well as the accounting and business departments, so that work can be readily handled, complaints quickly and quietly taken care of, and the accounts properly turned over to the business department for their record.

To me, such a corporation as our own closely resembles an army on the field of battle. There must be generals and subordinate officers in order to faithfully carry out the designs of the commander-in-chief. Should one of the lines be weakened, the brunt of the battle must, of course, be borne by those who take a determined stand. So it is with such companies as our own, which is organized into different departments. If one department makes an error or falls down in their effort to create business, then it is absolutely necessary for the other departments to rally to its support; otherwise the whole fabric goes to pieces. The best phrase that I can think of at this time would be "Co-operation and Mutual Understanding." Where this exists between the employes of each department and the departments themselves, success is bound to be earned for the company, and this, of course, spells success for every employe. I believe, if we thoroughly understood the meaning of these two words we should be "boosters" and not "knockers," continually looking out for the welfare of everyone.

The courteous salesman will find it very difficult to satisfy a displeased customer unless that customer knows that the various parts of the company are really one big unit.

I believe we should all remember that, like some of the famous men of the prize ring, there are four things that never come back—the uttered word, the sped arrow, the past life and the neglected opportunity. This neglected opportunity may be your psychological moment, but it always brings us back to the same place—"Co-operation and Mutual Understanding."

Norwegian hydroelectric plant costs vary for construction from 100 to 200 crowns ($26.80 to $53.60) per h.p for large water plants and from 100 to 500 crowns ($26.80 to $134) per h.p. for small plants. The rate at which the power is sold to consumers varies from 30 crowns ($8.04) per h.p.-year for large enterprises up to 50 crowns ($13.40) for small ones on a 24 hours per day service.

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POWER AND GAS

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The Principle of Progress

I am a prophecy of the future and the power which initiates new methods; a creator and a destroyer; iconoclast and builder. I also re-create, construct and reconstruct. I am founded upon knowledge and projected into the future years. I am both negative and positive; a dream and a reality, for I am Imagination.

* * * * * *

The comforts and conveniences which we enjoy today are monuments to the efficacy of controlled imagination, not only on the part of contemporary thought and endeavor, but to the crowd of witnesses who have preceded our generation.

Though building upon a foundation of the known, this imagination, reaching beyond accepted bounds, is found to be the most important factor contributing to progress in all departments of life.

It is an unsleeping dream, in which knowledge, combined differently and given new forms, results in something almost entirely different; a difference which may change the old order and make possible the inauguration of the new.

But having dreamed this dream of imagination, care should be observed not to publish it, but those truths only which will stand the test of this new light of an aroused intelligence.

Therein lies the rub.

That which is fanciful, unreal and illusory, without foundation and uncontrolled, has fastened itself to this word so that by many its good intent is eclipsed by its possible wrong application and use. It is looked down upon as unworthy and thought to have no place in every-day business affairs. Given a bad name which it indeed finds hard to live down.

Yet memory, the value of which none will discount, makes it possible only to recall that which has been. It is left to the imagination to reconstruct the past so that it may be applicable to the present and enlarge the future.

It is not, therefore, to be feared, but encouraged, provided that it is made positive or constructive in action and not negatively destructive.

The right use of imagination results in profit.

Imagination does not necessarily reach conclusions which are fictitious, impracticable and misleading, and is not unreal except insofar as it is a thought and not a thing.

It has been described as the experimental laboratory of the thought factory, for here new thoughts are fashioned which relate to human progress.

Progress is realized imagination.

Six hundred years B. C., the effects of electricity as produced by rubbing amber had been noticed and recorded, but it is only during the past thirty years that the value of this force has been gauged and so developed that every phase of business has been facilitated and the burden eased.

Those who merely gather facts along the line of their employment are of no more use than an incomplete reference work on the same subject unless they use these thoughts also in conjunction with the faculty of imagination, for the collector of facts, unless he does this, is merely one of those whom Professor Huxley once called "the patient hodcarriers" of advancing thought and action.

Imagination is valuable because it makes reasoning progressive, fills with enthusiasm and stimulates to achievement. It sees the desirability of the end sought.

No man is a success who has not imagined himself a success, for no accomplishment can occur unless it is first imagined.

Imagery of speech is not, but imagery of ideas is certainly essential to success.

The expression of these newly created images of thought constitutes individuality, which, in turn, is the hall-mark of success.

By right use of the faculty of imagination you cultivate success. This is the principle of progress.

Premiums as Discount

Public utilities usually sell their product at a gross price which makes an allowance for the excess cost of collecting delinquent accounts. Public service commissions recognize this and in rate-making the price is so arranged that a discount is allowed for prompt payment. The resultant net price is the actual rate or selling price of the commodity which allows a reasonable rate of return to the utility.

Whether the difference between the gross and net price is sufficient to cover this item and the necessity for this to be the case, is another matter.

Those customers making prompt payment purchase service at the lowest possible price, while delinquent customers pay at least part of the additional cost incident to their delinquency.

This review of a self-evident situation is made in view of the fact that one of the meddling magazines which would suggest something new to the utility—a method of increasing sales which none had previously thought out—recommends that premiums be given in place of the present discount which is believed to be "given, in order to bring in the money."

It is true that if the public has something to lose through being dilatory, their actions are thereby accelerated, but this does not alter the fact that the utility loses nothing by "giving" the discount or the further fact that the discount is not "given," but "allowed."

It is the customer's before he receives it if he will but keep his part of the contract and pay promptly, so that the utility is saved the otherwise inevitable collection expense.

This suggestion of the magazine in mention, that premiums—coupons redeemable in merchandise—be given in place of the discount, in order to boost the demand, shows that those advocating this procedure do not fully grasp the situation, and further emphasizes the necessity for specialization in public utility publicity.

Such irritating articles need a reliable counter-irritant.

It has been pointed out on several occasions through these columns that the giving of premiums, because wrong in principle and pernicious in practice, is therefore undesirable, but it is even more so under the disguise of "something for nothing" to make the customer pay for appliances in order to "boost demand," whether he wants to or not.

Public utility service is based upon broader lines and more honest dealings with patrons.

There is the greater objection that the giving of premiums injures legitimate business.

To give is never better than selling, for trade and not charity is the basis of present-day existence.

And public utility enterprises are now realizing more than ever before the relationship of the parts to the whole and of the whole to the parts. The rights of the smallest dealer, for example, are now protected by the central stations, not because of the possible impudence of this Skye-terrier to the St. Bernard of the electrical business, but because the present status of the industry and progress both plead for and meet with co-operative effort.

So in this brief review of the "interfering parrot's naughty frame of mind," we again make an appeal for specialization in utility publicity and point to the advisability of recognizing and supporting those specialized publicists which technical and trade journals actually are.

The County Fair

At one time the happy hunting ground of the confidence-man, the thimble-rigger and trickster; a place for the rural simplisicus to be doubly fooled and fleeced; and for sales to be made upon the old Roman principle of trading—caveat emptor—a process of change is now occurring which promises to reverse this undesirable status of the county fair.

Merchants, manufacturers and others appreciating the value of direct contact with a people who, in residence, are widely scattered and difficult to reach, have seized upon the county fair opportunity for the presentation of their wares.

And because residents of rural districts have a past county fair experience which many would gladly hide, and, if possible, forget, it has become necessary for exhibitors to actually demonstrate the superiority of their wares in order to convert the passing interest in the novelty of the thing shown into a permanent interest and purchase. The result is that the county fair has become an educational as well as a pleasurable affair, with the undesirable features all forced into the background.

Governments the world over have grasped this situation and as a result of their educational effort stock is improving, average yields are made to increase and the farmer is becoming more prosperous as he adopts the demonstrated superior method.

Central stations who have taken advantage of this opening are repeating the experiment and wherever the value of electrical exhibits of this kind is questioned it is because the opportunity has not been fully advantaged or the actual results not carefully traced.

In this issue is given a description of an exhibit and the immediately traceable prospective business If an exhibit is first made right and then followed up, and the farmer and his good wife not allowed to fall back into the former humdrum routine which they have learned to be unnecessary, county fair exhibits by central stations will prove themselves to be one of the most advantageous seasons at which to show the rural resident that it is better always to "Do It Electrically."

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

Sylvester M. Baker of the Macbeth Evans Glass Company, is at Los Angeles.

George Cook, of the American Cross Arm Company, was at Seattle recently on business.

George Gray, of the Crouse-Hinds Company, was in Seattle last week and left for San Francisco on Friday.

Frank Quinn, of the Manhattan Electric Supply Company, San Francisco, was at Seattle recently.

J. I. Coldwell, manager Seattle office Western Electric Company was at San Francisco during the past week.

H. Hays, of the Mt. Whitney Power & Electric Company, Visalia, Cal., was at San Francisco during the past week.

Geo. A. Boomer, Pacific Coast representative Plume & Atwood Manufacturing Company, is at Los Angeles, Cal.

R. S. Kennedy, of the American Electrical Heater Company, who recently spent a week in Seattle, is now at Vancouver, B. C.

C. Loveday, electrical contractor of Santa Barbara, was at San Francisco during the past week and also visited Sacramento, Cal.

E. C. McBrerity, western travelling representative of the American Electric Heater Company, Detroit, Mich., is at San Francisco.

George Riddock, secretary Bauer Fixture Company, San Francisco, has been elected a member of the Illuminating Engineering Society.

Louis E. Degan has been appointed consulting engineer by the Los Angeles city council for the bureau of fire alarm and police telegraph.

Hal Lauritzen, manager Western Division Holophane Works of General Electric Company, has returned to San Francisco from Los Angeles.

Geo. N. Rooker, manager of the Northern Idaho & Montana Power Company, Sandpoint, Idaho, was elected president of the Sandpoint Commercial Club at a recent meeting.

H. C. Goldrick, Pacific Coast manager Kellogg Switchboard & Supply Company, is making a business trip in the Northwest and will be away from San Francisco for about two weeks.

F. L. Webster of the Allis-Chalmers Manufacturing Company, San Francisco, has left for an extended trip throughout Eastern cities and will visit the factory of his company at Milwaukee.

R. St. John, formerly sales agent with the General Electric Company at San Francisco, is now representative of the Edison Lamp Works of General Electric Company at Los Angeles, Cal.

Morris Wenk had conferred upon him the degree of Electrical Engineer at the commencement exercises at Stanford University, California, this week. His thesis was "A Study of the Repulsion Motor."

F. N. Kollock Jr., until recently district manager for the Westinghouse Electric & Manufacturing Company at Seattle, Wash., has been made treasurer of the Westinghouse Lamp Company, with office in New York City.

T. B. Culhane and **J. Sandberg** of the sales department of the General Electric Company, have returned to Salt Lake City after a three weeks' trip through Idaho and northern Utah, where they have been on business for their company.

C. B. Kennedy, previously at the Lake Buntzen plant of the B. C. Electric Railway Company, Ltd., was at San Francisco last week, having stopped off en route to Bishop, Cal., where he has accepted a position with the Nevada-California Power Company.

General Irving Hale, formerly in charge of the Denver office of the General Electric Company, is a visitor in Salt Lake City over Sunday. General Hale has been in poor health for the past three years, and this trip is principally for the purpose of exchanging greetings with the men in the various offices formerly under his direction.

H. A. Lardner, Pacific Coast manager for J. G. White & Company, has left San Francisco for an extended stay at New York City. Mr. Lardner is also chairman of the committee on Pacific Coast relations for the International Electrical Congress at San Francisco in 1915 and plans to start active work at San Francisco on his return from New York.

A. H. Boyd, who has been with the Fort Wayne Electric Works since 1898, during the last four years of which time he was manager of the Philadelphia office, has resigned in order to accept the position of general manager and treasurer of the reorganized Santo Manufacturing Company. The new concern expect to continue the manufacture of the complete line of Santo Cleaners.

MEETING NOTICES.

Utah Society of Engineers.

The regular monthly meeting was held Friday evening, May 15th, at the Consolidated Music Hall. S. E. Park, engineer of the Utah Gas & Coke Company of Salt Lake City, read the principal paper of the evening on the subject, "Coal Gas Production."

Portland Section A. I. E. E.

The annual banquet and election of officers will take place at the Blue Room, Multnomah Hotel, Portland, Oregon, on June 2d, 1914, at 6:30 p. m. Reservations must be in the hands of the committee, L. R. Elder and L. T. Merwin, on or before May 28th. A good time and successful meeting is anticipated.

California State Association of Electrical Contractors.

Past successful picnics assure the success of the next annual picnic of this association to be given by San Francisco Local No. 1 for the benefit of the 1915 Convention Fund on Saturday, June 6, 1914, at Monticello Grove. The trip will be made by boat and dancing aboard is the order, as well as at the grove. All who can are urged to co-operate with the electrical contractors in making this picnic a huge success. Further particulars may be secured from W. S. Hanbridge, secretary Rialto Building, San Francisco.

San Francisco Electrical Development and Jovian League.

At the regular league meeting resolutions were adopted placing the league on record as favoring the provisions of the Stevens Bill which was so ably discussed at the previous meeting; and in favor of M. J. Sullivan as appointee for the office of city electrician which is now vacant. The meeting was then turned over to C. C. Hillis, chairman of the day who introduced J. G. Decatur of the Western Union Telegraph Company, who gave an address on the transmission of intelligence referring to the early and comparatively crude methods of signalling and tracing development up to the present day effectiveness of the telegraph. There was a representative attendance and the address was thoroughly enjoyed by all present.

The Jovian Electrical League of Southern California.

About 120 Jovians attended the weekly luncheon at Christopher's, Los Angeles, on Wednesday, May 13th, to listen to an illustrated talk on "The Instruments and Results Obtained at the Solar Observatory, Mt. Wilson," by Prof. Ferdinand Ellerman of the Mt. Wilson staff. The lecturer gave a vivid description of the many electrical and astronomical instruments in use at the station, mentioning in passing that 57 electric motors are in use for various operations. Many beautiful cloud and scenic effects were shown by means of

slides and the talk of the professor was as interesting as it was instructive.

The luncheon was presided over by H. L. Miller and a splendid musical program was rendered.

Utah Electric Club.

At the regular luncheon held at the Commercial Club Thursday, May 14th, Stephen H. Love, president of the Commercial Club Traffic Bureau of Salt Lake City delivered an address on the subject, "The Regulation of Public Utilities." Mr. Love has led the fight for the reduction of freight rates to the intermountain territory before the interstate commercial commission, and has acquired a most intimate knowledge of the elements of this important subject. The special committee on arrangements for the club's first summer outing to be given at Lehi, the trip to be made there over the new interurban electric line Saturday, May 16th, reported that all the details for the trip had been arranged, and that a most successful day was assured.

Annual Meeting Pacific States Electric Company.

The annual meeting of the district sales managers of the Pacific States Electric Company will be held at Los Angeles during the week May 25th to 30th. The meeting will be attended by W. L. Goodwin, general sales manager; D. E. Harris, district sales manager, San Francisco; Geo. A. Boring, district sales manager, Portland; E. A. Norton, district sales manager, Seattle; Ross Gilson, district manager, Oakland; F. J. Airey, district sales manager, Los Angeles; C. H. Carter, district manager, Los Angeles.

On completion of their meetings they will be joined by President H. V. Carter, and all will attend the Jobbers' Convention to be held at Coronado during the latter part of the month. The northern representatives will be accompanied by P. B. Hyde of the Thomas A. Edison Company. They will make the trip to Los Angeles via steamer.

MONSTER LOS ANGELES JOVIAN REJUVENATION.

The second rejuvenation of the present administration was held at the new Clark Hotel on Hill street on Friday evening, May 15th. Before the 100 Jovians and 60 candidates entered the banquet hall, general handshaking and good fellowship prevailed among those assembled in the beautifully appointed parlors. During the feast, a splendid cabaret show was presented, the same having been arranged for by Stentors Pieper and Morphy and the entire assemblage joined in the singing of popular airs, copies of which had been distributed among the diners. Statesman Colkitt then introduced Secretary Van Kuren as toastmaster, who in turn thanked the Stentors for their efficient services. These worthy gentlemen responded most happily by springing each other's stag stories on the unsuspecting and still uninitiated neophites, and then R. H. Ballard, secretary of the Southern California Edison Company, a candidate, responded to the toast, "Does it Pay to Become a Jovian?" He remarked that in view of the fact that this fine spread was given gratis to the candidates, it does pay to become a Jovian and spoke encouragingly of the esprit de corps among the electrical fraternity of Los Angeles, referring jokingly to the recent power bond election. He was followed by Max Loewenthal, who spoke in a serious vein on "Co-operation." He referred particularly to the need of merchandizing co-operation, especially the maintenance of prices and quoted from speeches on Co-operation by Jovians Crouse, Watts and others. He referred to the aid to be expected by the industry from the Society of Electrical Development and the need of a Pacific Coast branch of the society. He launched a plan for an electrical exposition in Los Angeles, directly after the close of the northern and southern expositions, affording the exhibitors at these places an opportunity to send their exhibits to Los Angeles before they are returned to the East. The 60 candidates were then taken in hand by the degree team consisting of the following:

J. G. Pomeroy, 820—Jupiter.
R. S. Clapp, 2000—Neptune.
Theo. E. Burger, 2624—Pluto.
L. E. Darrow, 10727—Vulcan.
D. H. Conover, 10725—Mercury.
H. L. Miller, 7405—Hercules.
J. C. Rendler, 7320—Mars.
G. E. Arbogast, 7376—Apollo.
S. T. Snow, 10774—Avrenim.

The "victims" were led throughout the lobby, street and kitchen, finally being conducted into the presence of Jupiter, whose throne had been erected in the specially appointed grill room. The services were impressive and well conducted and reflected much credit on the team.

The rejuvenation was, without exception, the most successful in the history of Southern California Jovianism and this was due largely to the untiring efforts of Statesman Colkitt. The first prizes for securing the largest number of candidates was divided between A. G. Drake and J. E. MacDonald, the prize for each being a Jovian ring. The former secured 17 and the latter 16 members. The second prize, a pair of Jovian cuff buttons, was awarded to Jas. Irvine, J. H. Pieper, who deserved second prize, being an officer, did not receive the same.

Among the candidates, a list of which follows, were 14 from the local Edison Company, 5 from the Pacific Telephone & Telegraph Company, 5 from the Riverside municipal plant.

Newly Initiated Jovians.

George Edgar Armstrong, Southern California Edison Co.
James V. Alexander, Southern California Edison Co.
Frank M. Balfour, Southern California Edison Co.
Knight Taylor Bennett, Western Construction Co.
George Wilson Barker, Standard Carbon Co.
Russell H. Ballard, Southern California Edison Co.
George Herbert Cederlof, John A. Roebling's Sons Co. of Cal.
James Hughes Cannon, Southern California Electric Co.
Thomas James Callaway, Towne-Lantz Electric Co.
Frank Mathews Coker, The Dean Electric Co.
Elmer Cutting, City Riverside Elect. Dept.
Joseph H. Cox, City Riverside Elect, Dept.
Irving Fisher Dix, Pacific Tel. & Tel. Co.
Lewis Degen.
Walter K. Farra, Greenwood Advertising Co.
Frederick F. Foster.
Walter L. Frost, Southern California Edison Co.
Herbert Bennett Fletcher, Southern California Edison Co.
William Lornax Graves Jr., Southern California Edison Co.
William John Gracer, Pacific Light & Power Corp.
Edmund Hatcher Granger, Granger-Hall Electric Co.
William H. Crumwald, Southern Sierras Power Co.
William Francis Gibbs, Western Electric Co.
John Francis Heath, Independent Elect. Supply Co.
Oliver Richard Hess, Pacific Tel. & Tel. Co.
Samuel Caldwell Haver Jr., Southern California Edison Co.
Edward Irvine, Independent Elec. Supply Co.
Edwin Aubrie Irish, Pacific Tel. & Tel. Co.
James Charles Jenkins, B. F. Kierulff Jr. & Co.
Robert William Jamison, Bell & Jamison.
Jacob Howard Leeds, General Electric Co.
Geo. E. Le Gassick, Woodill & Hulse Elect. Co.
John W. MacMillan, Mfgrs. Agent and Mdse. Broker.
Frank Emerson McKeever, Western Electric Co.
Charles Franklin F. McDonald, Western Construction Co.
Frank Thomas Maeesen, Pacific Light & Power Corp.
Charles Frederick Mason, Pacific Tel. & Tel. Co.
Harry Jack Moulton, Southern California Edison Co.
Roy Archibald Morehead, Pacific Tel. & Tel. Co.
Donald Riley Paramore, Southern California Edison Co.
Arthur Clair Putman Joint Pole Committee.
Charles Arthur Rowley, City Los Angeles Dept. Pub. Util.
William Rishebarger, Woodill & Hulse Elect. Co.
George Fred Roberts, J. E. Wilson Elect. Co.
Thomas Arthur Spencer, Gen. Delivery.
Z. Howard Sherart, Southern California Edison Co.
Marshall David Sedam, Pacific Tel. & Tel. Co.
John Thompson Shannon, Beardsley Electric Co
Henry Noteware Sessions, Southern California Edison Co.
I. Rosh Solomon, Gould Storage Battery Co.
Harry Elmer Stinchfield, City of Riverside.
Frank A. Short, City of Riverside.
Arthur Clayton Turner, City of Riverside Elec. Dept.
Frank Henry Trimble, Elect. Lighting Supply Co.
Eugene Lancaster Trowbridge, Westinghouse Elec.&Mfg.Co.
W. W. Van Deusen, W. W. Van Deusen Co.
Greenleaf Moores Woodbury.
Robt. Garfield Wagner, Wagner-Woodruff Co.
Walter F. Westbroot, Southern California Edison Co.
Arthur G. Yone, Southern California Edison Co.

RAILROAD COMMISSION OF OREGON.

As a result of an informal investigation on the initiative of the Commission into the matter of standards for maintenance of underground conduits, manholes, etc., a pamphlet of rules and practices recommended to utilities in Oregon in regard to protection to be afforded at manholes has been issued by the Commission. These rules are believed to be somewhat novel, and are a result of conferences with representatives of utilities following a manhole accident in Portland, this accident causing suspension of telephone, fire alarm and burglar alarm service in a considerable territory, for many hours.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The Railroad Commission has rendered a decision authorizing the Southern California Gas Company to issue $325,000 par value of its preferred stock and sell the same to N. W. Halsey & Co. This is a part of a $750,000 issue, which had previously been authorized, but which had not all been sold within the time prescribed by the original order of the Commission.

The Southern Counties Gas Company of California has filed an application with the Commission asking authority to cancel an escrow agreement with the Los Angeles Trust and Savings Bank dated March 9, 1911, under the terms of which 5000 shares of the 6 per cent cumulative preferred stock of the company was to be issued and registered by the bank. Under the agreement, there has been issued 3400 shares at the par value of $340,000 and there are unissued 1600 shares. The owners of the issued preferred stock and the officers of the bank have agreed that the authority of the commission under the terms of the public utility act over all issues of public utility stock is sufficient to safeguard their investment.

The commission has rendered a decision authorizing the Downey Light, Power & Water Company to sell its electric system in Los Angeles county to the Southern California Edison Company for $50,938.30. The selling company has been exacting a rate of 15 cents per kw.-hr. for lighting purposes, and 6 2/3 cents per kw.-hr. for power purposes. The Southern California Edison Company will reduce the rate for lighting purposes on a sliding scale of from 7 cents per kw.-hr. to 2½ cents per kw.-hr, and for power purposes on a scale of from 6 cents per kw.-hr. to 1½ cents per kw.-hr.

UTAH STATE BOARD OF EQUALIZATION.

The Board has valuated the properties of public utility companies in Utah, based upon the assessment made on January 1st of this year. The valuation of the principal public utilities are compiled as follows:

Interurban Railways—	
Salt Lake and Ogden	$ 564,650.00
Ogden Rapid Transit Co	241,225.00
Salt Lake and Utah R. R. Co	240,575.00
Total	$1,046,450.00
Lighting and Power Companies—	
Utah Light and Railway Co	$3,267,580.00
Utah Power and Light Co	2,405,925.00
L. L. Nunn Properties	55,415.00
Beaver River Power Co	100,275.00
Total	$5,929,195.00

EXAMINATION FOR EXPERT RADIO AID (MALE).

The United States Civil Service Commission announces an open competitive examination for expert radio aid, for men only, on June 17, 1914. The duties of position will be as follows: To direct and assist in the laboratory standardization tests of all circuits, instruments, and apparatus pertaining to and used in radio signaling; the practical installation, repair, and adjustment of radio apparatus both in shore stations and on ships; the development of special apparatus and methods of radio signaling suited to special conditions, and of new forms of sending and receiving circuits; to inspect the various radio stations when called upon and to make the necessary measurements of their electrical constants; and, in general, to carry out such work as may be necessary for the development of radio apparatus. They will be required to prepare technical reports of inspections, tests, and experimental research work. It is further desirable that they should be operators, but this not necessary. A rating of at least 70 per cent in the subject of training and experience is a prerequisite for consideration for this position. Age, 21 years or over on the date of examination. Persons who meet the requirements and desire this examination should at once apply to the United States Civil Service Commission, Washington, D. C., or to the Secretary of the United States Civil Service Board for application Form 1312, stating the name of the examination for which the form is desired.

NEW CATALOGUES.

The American Blower Company has issued Bulletin 35, Series 1 describing the use of the Pitot Tube for fan testing. Much valuable data and a number of test charts are given.

Laboratory Ozone Apparatus is the title of an eight page booklet issued by the Sprague Works of General Electric Company. Ozone mixers, air filters and industrial ozonators are also illustrated and described.

Bulletin No. 41010 of the Sprague Works of General Electric Company, illustrates and describes in detail that company's make of d.c. motors, Types C and D. A number of illustrations showing the application of these motors, is also given.

Standard Underground Cable Company, Pittsburg, Pa., has just issued bulletin No. 200-1 giving specifications for Standard C. C. C. (Colonial Copper Clad) wire, hard drawn, bare, 30 per cent grade. New Bulletin No. 400-1 of the same company deals with weatherproof insulated wires and cables, solid and stranded, double and triple braid.

Fairbanks-Morse d.c. type "CP" motors and generators are described in bulletin No. 27 and type "TRL" in bulletin No. 29 just issued by that company. Type "B" constant speed induction motors, horizontal and vertical, together with starters for same and complete data is given in bulletin No. 202H, while No. 210 gives full information regarding Fairbanks-Morse internal starter motors. The manufacture and construction is also fully described in each case. The bulletins may be obtained by addressing the nearest office of the company.

The Westinghouse Electric & Manufacturing Company has recently issued a number of publications dealing with the different lines of apparatus manufactured by that company. Among these are Section 3082, Motor-Driven Pumps. This publication has an attractive art cover, and is profusely illustrated with views of installations of pumps of various kinds and performing duties of a varied nature. Table are given showing the frictional heat in wrought iron pipe, horsepower for pumping, standard dimensions of pipe, and atmospheric pressures, equivalent heads and suction lifts. Ironing, a Pleasure, Folder 4281 describes the household and travelers iron manufactured by the company. On the front page is a picture of the cutout representing "Dorothy" ironing. This device is furnished dealers and central stations by the Westinghouse Electric Company for use in their campaigns. Westinghouse 56 in. d.c. Ceiling and Column Fans are described and illustrated in Folder 4282. The KD Battery Charging Panels for Two-Wire Systems, 50 to 250 volts. Leaflet 3719 describes and illustrates the panels for systems above mentioned for lighting and electric vehicle charging. Typical diagrams of connections are shown.

PUBLICATIONS RECEIVED.

"Determination of Ammonia in Illuminating Gas," is the subject of Bureau of Standards, Technologic Paper No. 34, by J. D. Edwards. Experimental results obtained in the course of a brief investigation of the apparatus and methods employed are presented. Five forms of apparatus have been studied and their relative accuracy determined. Suitable indicators have been recommended and precautions to be observed in the operation of the different forms of apparatus have been pointed out. Copies of this paper may be had upon application to the Bureau of Standards.

ELECTRICAL CONTRACTORS' DEPARTMENT

COST-KEEPING APPLIED TO ELECTRICAL CONTRACTING.

BY E. H. WEST.

(The author outlines the purpose of cost keeping, its objects and possible economies; differentiates between it and bookkeeping and outlines the essentials of a system at once simple though satisfactory for the electrical contracting business. The paper was presented by Mr. West, who is efficiency engineer, Portland Railway, Light & Power Company at a recent meeting of the Northwestern Electrical Contractors' Association.—The Editors.)

It might be well to outline the purposes and objects of cost-keeping. There are two primary objects. The first is to enable the proprietor or manager of a plant or industry to analyze his costs with a view of securing the most efficient and economical result from the work under his direction or supervision; second, to enable him to provide a record that he can refer to in making up estimates of the probable cost of work in view. In making up his analysis of costs, as outlined under the first condition, according to Gillette he naturally looks for the following:

First—Excessive use of material.
Second—Lost time or unoccupied time of the workmen.
Third—The excessive use of small supplies.
Fourth—The efficiency of the foreman, or the man in charge of the work for him.
Fifth—The padding of pay rolls.
Sixth—The improper planning or routing of jobs.

The second primary object, as stated above, necessitates a clear-cut office system that will enable foremen or others who make up estimates to get complete data quickly. Bookkeeping and cost-keeping are two separate and distinct functions. It is true that the bookkeeper can be used in keeping cost accounts, or the cost accountant can get out a balance sheet, but the functions of the two classes of work are distinctly different.

First—The bookkeeper's work ends when he has turned out the final balance sheet. He shows the financial status of the firm. If it is losing company, he shows it. He does not show where it is losing money, or how it is losing money, but simply that it is losing money. The cost accountant, on the other hand, using the same figures that the bookkeeper has used, makes up, in tabular form, comparative statements of costs, showing what similar work has cost on various jobs, showing the reason for the costs going up on certain jobs and by the very fact of his doing so enables the manager or proprietor to devise methods to produce desired efficiencies. Bookkeeping has been termed "the process of recording commercial transactions for the purpose of showing debits and credits between accounts." These accounts may be individuals or firms, or they may be arbitrary accounts. The latter being an evolution in bookkeeping after individual accounts became so large or so complicated as to be insufficient to show the status of the business and the profits derived from any given transaction. Cost-keeping, on the other hand, is the process of recording the number of units of work and the number of units of material entering into the production of any given structure or into the performance of any given operation. To these units of work or material actual or arbitrary wages or prices may or may not be assigned.

The object of cost-keeping is primarily to show the efficiency of performance, hence actual money disbursements need not be recorded as in bookkeeping. This distinction is vital, and will be discussed at greater length.

The previous statement may seem inconsistent with some of my former remarks. Inasmuch as I stated that the object of cost-keeping is primarily to show the efficiency of performance, hence actual money disbursements need not always be recorded as in bookkeeping. I make this statement advisedly, although we invariably consider the necessities and operations of life in terms of dollars and cents.

Actual money disbursements need not always be recorded, for in the working out of costs of doing work a $5.00 man may do as much of the same kind of work, in exactly the same time as a $2.00 man could do it. Therefore, the matter resolves itself into a study of hours and minutes in the case of labor, and into units of weight, length, or pieces in the case of materials. Many contractors combine cost-keeping and bookkeeping and make an attempt many times to have a cost-keeping system so elaborate that it will be the bookkeeping system, too. Doing this, you are burdening the bookkeeping with a great deal of material that does not belong to it and piling up, or increasing your cost-keeping expense under an avalanche of details that are destructive to the value you are attempting to secure from your cost-keeping records.

Bookkeeping records are usually a month to month proposition; cost-keeping records show a daily result and the manner in which the work has been conducted on a particular job. The books close at the end of the month, and the consumer or customer is billed with the contract price of the job, or the cost on a labor and material basis. If the latter, the contractor is reasonably sure of a profit, providing he has taken into consideration that intangible and fickle item—overhead expense or burden.

Cost-keeping, when conducted properly, tells you day by day the progress of the work on a job, its cost as compared with its estimated or allowed cost, and just what, if conducted properly, will be necessary in order to complete the work within the prescribed limits of time and money.

The bookkeeper makes no mention or pays no attention to the matter of job costs until same is completed; neither is he interested in weather conditions or distances; the cost-keeping accountant and estimators must take those things into consideration.

With cost-keeping records, sketches and plans of work performed are an essential part, and such things, if added to the bookkeeping record, would only confuse them.

I think I have satisfactorily outlined the differences between cost-keeping and bookkeeping.

In connection with your cost-keeping work, it is necessary to have several allied systems of records—first, a balance of stores system; in other words, a system that will keep track of all of the available material that goes into each job, the amounts on hand for the job, and the time at which material should arrive in order to complete the job efficiently and economically. How many times have you started out to do work with only half of the material available, and found it necessary to send a high-priced workman to the supply house to secure the balance of the material needed, or had to quit work on a job because you were waiting for material to arrive, where if you had properly planned out your work in the first place, secured or had available all of the material and had it ready for the job when you were ready for it, a considerable amount of time could have been saved with a monetary saving to you. As important to keeping your stock listed and properly balanced is the matter of time-keeping. Ordinarily time is charged to a job number and turned into the bookkeeper, and so long as the total number of hours worked checks with the foreman's report, the man is reasonably sure of securing his weekly or monthly wage.

Time-keeping can be simple or complex. When the light and power department of the P. R. L. & P. Co. had its time-keeping done by the bookkeeping department, three men were required to take care of it. When the time-keeping was put under the cost-keeping system, one man took care of, and still takes care of, the entire matter. There are many ways of recording time, from the simple system of a foreman's note book to the more elaborate one of having a card for every

operation performed which involves the use of some form of special time-calculating device.

The Cost Chart (Fig. 1) illustrates the manner in which expenses get into total cost. To institute such a system is not a complicated matter, nor does it require any elaborate bookkeeping or cost-keeping force. By having a proper system of time cards, material requisitions and cartage slips, the direct expense item of total costs is not difficult to obtain; but the burden expense (that bug-a-bear of indus-

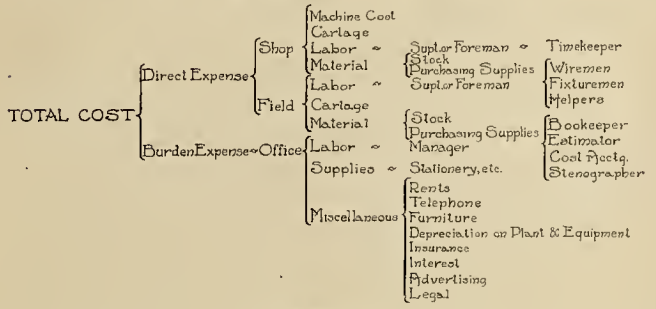


Fig. 1.

trial commercialism, which because of its very nature and existence is a burden) is not so easy to apportion. Hardly any two people agree in the manner in which it should be taken care of. However, for the purpose of your work some uniform scheme should be adopted and adhered to. I strongly condemn the standard practice of apportioning total burden costs on a percentage basis to the total cost of material and labor. I would apportion "burden labor" and supplies on the basis of labor hours to a job, and the miscellaneous expense on the basis of total direct cost. The first, because burden labor is principally necessary in order to supervise and take care of the direct labor employed on the job and to see that such labor performs its work economically as regards time and material. You say, "What about the direct supervision? Is not that supposed to supervise the direct labor?" The answer is most decidedly "Yes," but only as regards proper and correct work; seeing that the proper kind of workmen are used, that each operation is done in its turn and that the proper material and tools are on the job to work with. The purchase and shipping to the job of the tools and material is up to the office, and the getting of the job done in time is also up to the manager or proprietor (in the case of small concerns where the proprietor is the manager).

A cost-keeping system fits in and is just as important to your line of work as it is to any other. Your business is not so different that the value of cost-keeping can be overlooked or disregarded. The elaborateness of the system, however, can, and does often, overwhelm the person attempting to put it in.

First, because many (so-called) experts have cropped up all over the country with systems of card records and loose-leaf ledgers that have plunged small organizations in a mass of worthless detail.

In scientific management the term "production engineering and cost and planning department" are often heard. You can have a cost and planning department in your own organization (see Fig. 2). The proprietor or manager of a small concern can be the production engineer, or planning engineer. Some one man of your organization can be delegated the task of material and tool man; the bookkeeper himself can take care of the job cost records; the production man can each day lay out in advance the work that each one of his crew is to do the next day, basing the task assigned on his own intimate knowledge of what it is possible to do. In order that he may be able to do this intelligently, he should work by means of sketches, rough—overall dimension sketches are enough in addition to his knowledge of the particular ground he is to cover. By having material estimate sheets, similar to the one I am showing you here (Fig. 3), it will be possible for the planning man to lay out the operations of the work to be performed together with detailed lists of material. This he can turn over to his material man to have filled. By going over the jobs on hand the exact time in which the last job that came in can be done is readily determinable. The cost-keeping work can be taken care of day by day by the bookkeeper, who will enter up on his copy of the estimate the material

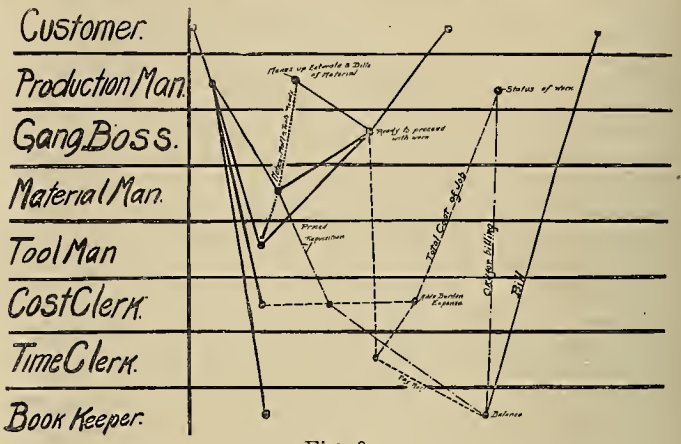


Fig. 2.

and labor costs that have come in, and will note exactly how the job stands. It will be his duty to notify the manager or the production man of the status of the work, and as soon as the estimated expenditure is about reached, he should have the production man go over the work with him to see where changes or adjustments in the working schedule can be made that will keep the total expenditure somewhere near the estimated amount.

The production man will receive all jobs arriving in the shop; he will number them, and it is his duty to issue the instructions to the cost clerk and the material man. He should make up the material list, tool assignment and job instruction cards or estimates. He should designate the particular sequence of operations on each job, and the exact route and order each operation of the job must take. From his knowledge of his force he should assign the workmen to each operation and task shown. All of the information concerning the work going on in his business should be shown on a large sheet or blackboard, which we will call for con-

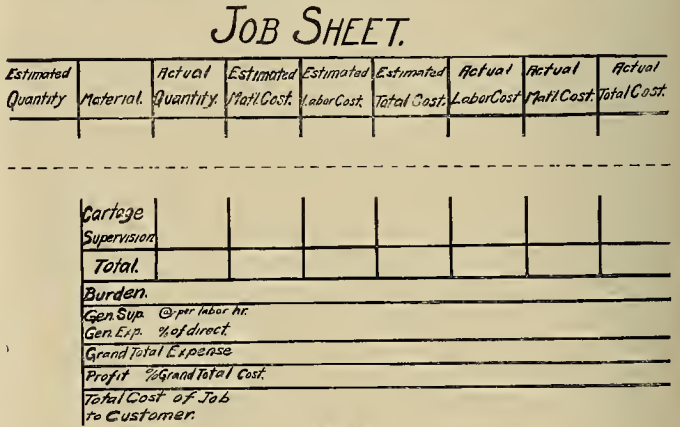


Fig. 3.

venience a dispatching record. Its purpose is to show the work projected and under way. It will be his daily record of the status of each job. He will note on it the time in which the job should be completed, and he can tell as he goes over the record each day just how each job stands. Of course, many of you will say right away that you have been doing this for a long time. You have not had the elaborate records,

etc., that I am talking about, because you have carried it all in your head, and that is just the very point I want to bring out.

The difference between scientific management and rule of thumb methods is largely the difference between careful, systematic recording of operations and events and attempting to carry in the head the same operations and events, which cannot be done unless you have only one small job under way.

Another function of costs and planning is that of the time clerk. In a small organization the bookkeeper and the production man naturally take care of the time. For convenience a small rack should be made to hold the cards for each workman. There should be two spaces assigned each workman — one for the finished work and one for the work under way, or to be done. After he has performed the particular task assigned to him, he should turn in the time card and receive or take from his rack the card for the next work that is to be done. From these cards, both for his productive and non-productive time, which should all be taken care of, the bookkeeper will make up the payrolls, or pay checks, and will enter the time against the jobs worked on the job sheets themselves. It is not expected that I can tell you exactly how your cost-keeping work should be conducted for the very reason that conditions vary. What might apply to one shop will not apply to another, but the fundamental principles involved have been applied to millinery establishments with just the same success that they have been applied to large iron and steel industries.

Planning, routing work and cost-keeping have also been carried out along the lines just mentioned in boat-building establishments and sawmills. The Yale & Towne factory in Connecticut, that manufactures all of the Yale locks, and the Link Belt Manufacturing Company, in Philadelphia, are two of the best examples of plants operated under the Taylor System of Scientific Management.

A progress cost curve that is very easy to make and keep up for each job under way should be used. On it you will require the cost man to make the necessary extensions daily, and by being sure that your manager or proprietor initials same every night, there is no excuse for your not knowing just what the status of each job is.

TRADE NOTES.

The Mohrlite Company has secured the lighting fixture order for the Orient Building, Pine street, San Francisco. The equipment includes 56 Mohrlite indirect units.

The Telephone Electric Equipment Company, San Francisco, has succeeded Jno. R. Cole, who resigned as agent for Harvey Hubbell, Inc., of Bridgeport, Conn.

Plans have been completed for the erection of a new engineering building to cost $200,000 at the University of Southern California. The building will occupy 150 feet frontage on the present site of the engineering and chemistry buildings.

The Santo Manufacturing Company, Philadelphia, Pa., announces the purchase of the patents and manufacturing facilities of the Keller Manufacturing Company and will continue to manufacture and market the well known Santo Vacuum Cleaners. The business will be conducted under entire new management, but the same engineering and manufacturing organization have been retained, thus insuring the same high quality of product as heretofore.

The last gap in the Northwestern Pacific railway from San Francisco to Eureka, Cal., has been reduced to seventy miles, being covered in auto stage. A daily schedule of daylight service has been established so that it is now possible to make this trip in 26 hours, including one night stopover at Fort Seward. This road is of peculiar interest to the engineers because of its electrification possibilities by means of abundant water power in the region traversed and because of its rich lumber resources.

CALIFORNIA ASSOCIATION OF ELECTRICAL INSPECTORS

Section of N. A. E. I.

C. W. Mitchell, President. Arthur Kempston.
Wm. G. Pennycook, Vice-Pres. B. C. Hill, Executive Comm.
John W. Carrell Secretary-Treasurer, 55 Fulton, San Francisco

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correllate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

By the Secretary.

The C. A. E. I. held its May session in the council chambers, city hall, Berkeley, and were the guests of City Electrician W. E. Brothers. The topic for the session was "Wiring and Equipment of Meter Locations."

The National Code contains no especial provisions which govern the wiring and equipment of meter locations, except that the main service switch and cutout must be arranged to cutoff the current from all devices, including meters; but the general provisions for protecting wires by fuses and for the mechanical arrangement of wires and devices apply. The methods used in the several districts appear to be somewhat different but a tendency to group all meters for each building in one location was reported. The easiest way to treat the subject seems to detail the best defined systems separately.

Rigid Conduit and Metal Troughing System Method: All wires must be enclosed in a wire way of rigid conduit or metal troughing, except as otherwise herein provided. The completed wire way must enter each cabinet which it adjoins with a bonded and bushed joint; must be grounded, and be large enough to easily contain all the wires.

Switches and Cutouts: All switches and cutouts must be enclosed in one or more metal cabinets; all cutouts grouped as far as practicable. All cutouts may be and all service cutouts must be in a single group.

Metal Troughing must be of galvanized metal at least No. 24 V. S. gauge in thickness (equivalent to No. 22 B. & S. gauge) and must consist of a base and a cap each made in one piece. The base must form three sides of the enclosure and the cap shall include grooves made to confine the edges of the base so as to form slip joints. Holes, spaced 12 in. for No. 10 standard machine screws equipped with nuts, must be placed in each sliplock joint. The completed troughing must form a bonded wire way free from projecting edges, burs or fins.

Wires: Wires may project from the wire way and be exposed for 12 in. for meter connections but a separate hole of proportionate size equipped with an insulating bushing designed for the purpose must be provided for each projecting wire. No wire shall project through the cap of any metal troughing. Each wire must be in one continuous length from cabinet to meter, from meter to cabinet, or from cabinet to cabinet, as the case may be, and no splice tap or connection shall be made in or to any wire in the wire way.

[To be continued.]

PLAY BA—A—A—LL.

The Rock Ridge Amateur Baseball League, containing eight very fast semi-pro teams, started their last winter's schedule on October 26th, played a series of twenty-one games, of which the team representing the Great Western Power Company landed the pennant offered by A. G. Spaulding & Company and the silver cup given to encourage clean amateur baseball by the Fred E. Reed Company, Syndicate building, Oakland, Cal.

INDUSTRIAL

THE TITAN STORAGE BATTERY COMPANY.

An important event in the storage battery industry has taken place. We refer to the change in the name and the location of the company which has heretofore done business as the Baltimore Electric Storage Battery Company with factory and offices in Baltimore.

Henceforth the company will be known as the Titan Storage Battery Company Extensive new quarters have been secured in Newark, N. J., at Chapel street and Lister avenue, at which point the offices of the company have been established for some time and the manufacturing equipment is now in operation so that the Titan vehicle batteries, Plante batteries, lighting and sparking batteries, and "self-starter" batteries are being shipped from the new location."

The removal was brought about by the necessity for increased facilities and the fact that the Newark location possesses advantages over what could be procured in Baltimore. The change in name is a move in the direction of simplification and is made possible through the fact that it is no longer desirable to identify the company name with the location.

The officers of the Titan Storage Battery Company are as follows: Henry M. Keith, president; Daniel C. Spruance, vice-president; Edward S. Hyde, treasurer; Henry H. Hanson, secretary. These gentlemen, with Minor C. Keith and John G. Gray, constitute the board of directors. Dr. W. E. Winship is general manager, A. H. Mustard is sales manager, and Eugene Handler is superintendent. No change in the policy of the former company, beyond that of enlargement and expansion of operations, is indicated by the change in name and location.

The control continues in the hands of Minor C. Keith, vice-president of the United Fruit Company and president of the International Railways of Central America.



General View of Titan Storage Battery Plant.

SWITCHBOARD AMMETERS AND VOLTMETERS.

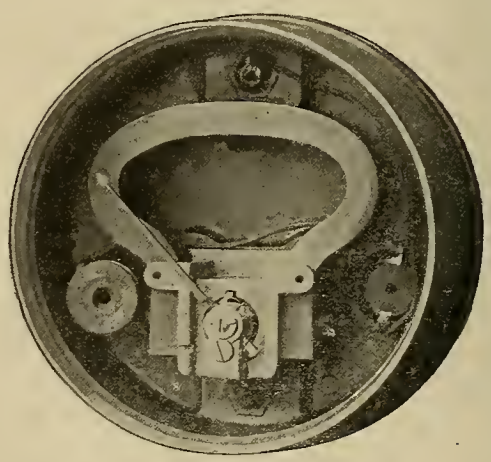
A new line of 5 in. d.c. indicating ammeters and voltmeters, known as the type FW, and suitable for small isolated plants, yachts, battery-charging panels, etc., where a high grade low price polarized instrument is required, has just been placed on the market.

The meters operate on the D'Arsonval principle, having a moving coil and a permanent magnet, and possess many points of superiority to the cheaper types of construction usually found in low priced meters.

The complete movement is mounted in the case as a unit. A unique feature is the arrangement of the moving element, which can be taken from the movement by simply removing two screws on the side of the pole piece support. The entire moving element and bearings can then be lifted out as a unit and can be replaced in exact position. This makes it possible to repair the meter without disturbing the alignment of the magnetic circuit.

Owing to the use of an aluminum pointer, a light counter weight is possible, resulting in a light weight of movement and small wear on the pivot jewels. The high torque, in proportion to the light weight, insures great accuracy considering their size.

Their scales are 4 in. long., which is practically the same length as the scales of many 7 in. meters. The full length of the pointer shows on the dial, thus making the meter as easy to read as a clock. The movement is thoroughly damped to secure dead heat readings. These meters are manufactured by the Westinghouse Electric & Manufacturing Company.



View of Meter With Dial Removed.

Although somewhat diminutive in size they are not in any sense competitive with many "toy" meters on the market but are designed along strictly scientific lines and possess a high grade of quality.

NEWS NOTES

FINANCIAL.

SAN FRANCISCO, CAL.—The directors of the Northern California Power Company have voted to submit to stockholders a proposal to authorize $2,000,000 6 per cent cumulative preferred stock, of which only $500,000 will be issued at this time. A meeting of the stockholders has been called for July 17th to vote on the question.

LOS ANGELES, CAL.—The plan of procedure for acquirement of money on the recently voted power bonds has been a subject of general discussion. If it becomes necessary the city will endeavor to secure the $1,250,000 necessary to carry on work towards completion of the power plant by purchasing the bonds to this amount with cash from the sinking fund. The question of the validity of the proceedings in the various steps calling the bond election, and the validity of the bonds themselves, has been submitted to the bond experts, Dillon, Thomson & Clay, of New York City. This firm is to receive $1000 regardless of the nature of the opinion, as a retaining fee; $2500 if the opinion for any reason is adverse to the validity of the bonds, or $5000 if the opinion is favorable. Meanwhile the city attorney will be asked to determine whether the board of public works or the public service commission has the power to handle the expenditures, if money is realized on the bond issue..

INCORPORATIONS.

SAN BERNARDINO, CAL.—Plans to develop water and put under cultivation hundreds of acres of land in Pariso valley, near Newberry have been disclosed by the filing of articles of incorporation of the Pariso Valley Land & Irrigation Company, with authorized capital of $800,000. James. O. Parker, Frank P. Apperson, and Frank O. Little are directors.

LAS VEGAS, NEV.—The Colorado River Hydroelectric Company, with a capital stock of $5,000,000, has been formed to construct a dam to develop immense power going to waste in Colorado River. The directors are Wm. Forman, Thomas Lindsey, W. R. Williams, Henry C. Schmidt and M. B. Schmidt, all of Tonopah. Surveys are now under way and construction work will begin this fall. The plant will be located at Boulder canyon, east of Fort Callville.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed of the San Francisco Northern Railway Company. Forty-two miles long, the road is to run from Pt. San Quentin, Marin county, to Santa Rosa, giving Richmond and the rest of the east shore connection by ferry and rail with the north of bay region. Of the capital stock of $2,500,000, in $100 shares, 5000 shares are preferred. The five incorporators and directors have taken $10,000 worth each. They are Allen L. Kittle of Ross, Archibald Borland of Oakland, Frank A. Brush of Santa Rosa, William L. P. Jackson of San Francisco and John C. Kittle of Ross.

ILLUMINATION.

TILLAMOOK, ORE.—The city council has granted a 25 year franchise to the Tillamook Light & Fuel Company.

TACOMA, WASH.—The county commissioners awarded the Vashon Electric Company a franchise to operate an electric light and power plant on Vashon Island.

AUBURN, WASH.—J. L. Veach has been granted authority to construct pipes for the transmission of gas within this city. His company will install a plant to cost about $40,000 or $60,000.

PORTOLA, CAL.—The supervisors of Plumas county have granted a franchise to R. B. Young of Loyalton to construct and operate an electric light system for the town of Portola and vicinity.

FLORENCE, ARIZ.—The city council has instructed the city engineer to investigate what legal steps are necessary for the city to proceed to raise the money and to install a municipal electric lighting plant.

SAUSALITO, CAL.—The Pacific Gas & Electric Company has been granted a franchise to erect electric lines for transmitting electricity in Marin county for light, heat, etc., in Bolinas and in Willow Camp particularly.

COLORADO SPRINGS, COLO.—The city council has under consideration the proposition of installing a municipal electric lighting plant. Bonds in the sum of $150,000 were voted for this purpose in 1907, but no action has been taken up to the present time.

GREEN RIVER, UTAH.—A special election will be called in the near future to vote on the issuance of bonds for the purpose of erecting an electric lighting plant and distribution system. Information in regard to the same may be had by addressing the town clerk.

GLENDIVE, MONT.—Two applications have been filed with the city council for franchises to erect a gas plant and distributing system in this city. One is asked for by F. P. Leiper and the other by E. T. Williams and R. B. Morrison. Both these applications are under advisement by the Council.

NEHALEM, ORE.—Steps have been taken for the purchase of the Nehalem water system and the installation of a municipal electric lighting plant here. The company owning the plant is willing to transfer the plant at a reasonable figure. An election will be held at the earliest possible date, at which time the people will be asked to authorize the issuanec of sufficient bonds for the purchase of the water plant and the construction of a power plant and lines for local service.

ALAMEDA, CAL.—Although the electric light plant is self sustaining the board of electricity has submitted to the council its estimate for the ensuing year. The receipts for 1914-15 are estimated at $176,300, which includes $25,000 for city lighting, but which is not paid from the taxes. The estimated expenses are $112,431.25, which include interest and redemption on all bonds. Besides paying for the city lighting, which is accounted at two and one-quarter cents per kilowatt hour, all extensions, depreciation and bonds are taken care of. It is also estimated that after the year's business there will be a balance of $38,868.75, which will be used as a replacement fund and working capital.

SACRAMENTO, CAL.—Master in Chancery Harry M. Wright has upheld the legality of the 75 cent rate for gas as provided for in the ordinance passed by the supervisors last July, ruling that this rate, which returns 6 per cent on the company's property as valued by the Master in Chancery, is not confiscatory. The Pacific Gas & Electric Company's rate previously was 85 cents and it has been collecting this amount since the ordinance passed through a restraining order issued by Federal Judge Van Fleet. In his findings the Master in Chancery reduced the valuation of the corporation's plant from $19,937,267 claimed by the company to $12,042,590. He refused to allow for rate-fixing purposes the company's franchise, which was estimated at $1,482,641, struck out the "going concern" claim of $2,918,107 and disallowed overhead charges, $625,259; working capital, $401,433; dead mains, $344,651; additions to inventory, $126,478, and obsolete coke ovens $42,840. He also reduced by $1,670,065 the company's estimate of reproduction cost. The decision will not become effective until it is passed upon and signed by U. S. Judge Van Fleet.

TRANSMISSION.

SOUTH BEND, WASH.—Frank Mackean of Seattle manager of the Willapa Power Company, has applied for a franchise to furnish power in Pacific County.

BOISE, IDAHO.—William C. Hazzard of Milwaukee, president of the Clear Lake Power Company, has filed an application to construct and maintain electric transmission and distribution lines in Twin Falls.

SANDPOINT, IDAHO.—Local Manager G. N. Rooker of the Northern Idaho & Montana Power Company, has closed a contract to furnish the Northern Pacific railway division shops with electric power for five years.

LEWISTON, IDAHO.—The council has appointed Emery A. M. Roberts, W. H. Morey, and L. A. Porter to look into the matter of constructing a dam in the Clearwater River for the installation of a municipal power plant. The estimated cost of the project is $500,000.

SAN FRANCISCO, CAL.—Work has been commenced by the Henry Peterson Launch Company laying a new transbay submarine cable for the Great Western Power Company. The work is being done from a 400-ton barge. The cable, which is said to be the heaviest ever manufactured, will extend from the Western Pacific mole on the Alameda shore to the foot of Folsom street. The new line will replace the former cable of the power company which was laid about two years ago.

OGDEN, UTAH.—Extensive damage was done to electrical equipment last week by a severe electric storm which passed over the city from lake to mountains. Portions of the business and residence sections were in darkness for several hours as a result of the burning out of transformers. A bolt of lightning struck the Virginia Hotel, Adams avenue and Twenty-fourth street, burning out the lighting system. The hotel was slightly damaged by the fire which resulted from the lightning. During the storm the entire fire alarm system was put out of commission, and the telephone lines to both fire stations were also burned out. Although the storm was accompanied by a severe rainfall and a brief fall of hail, the resulting damage will not be great.

TRANSPORTATION..

GLOBE, ARIZ.—An election will be held here May 26th, to submit to the voters a franchise for the construction of the Globe-Miami electric railway. If favorably voted on work will begin June 1st.

PHOENIX, ARIZ.—The state corporation commission has issued an order requiring all locomotives used in handling trains in Arizona to be equipped with electric headlights within sixty days from May 15th. The lights to be used shall not be of less than 1000 candlepower.

POMONA, CAL.—The Pacific Electric Railway is making preparations to build a cutoff on the Los Angeles-Pomona Interurban line, from Lordsburg to North Pomona. The proposed cutoff will parallel with the Santa Fe tracks from Lordsburg, and will connect with the Pomona line near La Verne Heights packing house.

VISALIA, CAL.—Frank C. Avery, the promoter of the Big Four Railroad says that negotiations are pending for the sale of the franchise and the completed roadbed of the company to a syndicate of San Francisco capitalists. Negotiations for the sale of the road are in the hands of John R. Hitchcock of Tulare, president of the corporation.

SALT LAKE CITY, UTAH.—General Manager Joseph S. Wells of the Utah Light & Railway Company, announces that the company has decided to give up all their present plans for the extension of its Davis county interurban line to Farmington. The reason for this change of plans is ascribed to the fact that the town council of Farmington has attempted to place restrictions on the company and to require extensive grading and street opening, the cost of which would aggregate $30,000. The company states that it does not feel justified in making the extension under these circumstances.

SAN MATEO, CAL.—The directors of the San Francisco-San Mateo Interurban Right of Way Company, which was organized by the San Mateo County Development Association to build an electric line from San Francisco to Palo Alto, has elected officers as follows: H. C. Tuchsen of Redwood City, president; D. G. Doubleday of Millbrae, vice-president; E. M. Moores of Burlingame, treasurer; F. Eksward, secretary. M. B. Johnson, T. Masterson, F. A. Cunningham and W. A. Brewer are the other directors. The sole object of the directors is to establish an independent railroad down the peninsula.

LOS ANGELES, CAL.—The final draft of the notice of sale for a forty year franchise to contruct and maintain the proposed elevated railway from the Pacific Electric Company's Sixth street depot to San Pedro street, connecting up with the municipal line on that street, has been placed in the hands of the board of public utilities by Assistant City Attorney Howard Robertson. The building of the proposed elevated structure will be the first link in the Pacific Electric Company's proposed elevated scheme which will represent an investment of about $12,000,000. The notice of sale for a franchise covering this first link of the elevated scheme provides for ultimate municipal ownership.

SANTA ROSA, CAL.—F. A. Brush of Santa Rosa, who is a director of the Petaluma & Santa Rosa Railroad Company, is quoted as saying relative to the incorporation of the San Francisco Northern Railway Company: "The new company will control the Petaluma & Santa Rosa road and provide the financial sinews to build extensions and new lines." Eventually, he said, a line would be built from Petaluma south to San Francisco Bay, where he and Borland, Dibblee and the Kittles own a terminus. In the near future a direct line between Petaluma and Santa Rosa will be constructed, to replace the long distance route by way of Sebastopol. Another early probability is a line from Santa Rosa to Healdsburg, 16 miles distant.

STOCKTON, CAL.—Officials of the Central California Traction Company a few days ago made a thorough inspection of the company's city lines with Commissioner of Public Works O'Keefe and all places where improvements were needed were pointed to the railroad men and they promised to improve the road in the very near future. They discussed the possibility of abandoning part of the franchise in order to give better service on the remaining portion, but nothing definite was announced in this regard as the matter must be decided by the board of directors. Messrs. Alden Anderson and M. Fleishhacker, two of the company's officials who made the inspection trip, stated that plans for extensive improvements were under way for the Stockton system and that the matter would be thoroughly threshed out at a meeting of the directors in San Francisco within the next week. The roadbed of the company will be put into first class shape and the street car service will also be bettered.

TELEPHONE AND TELEGRAPH.

HONOLULU, T. H.—Improvements to cost about $40,000 are to be undertaken in a short time in connection with the system of the Hawaii Telephone Company. When completed, probably about December 1st, the island will be belted by metallic circuit trunk lines which will make the country service second to none. Besides this, the city of Hilo is to be relieved of overhead telephone wires, through the installation of underground cables and conduits to replace them. The Mutual Telephone Company, which for some time has been in control of the Hawaii company, is making all these things possible. The Mutual has decided to loan $30,000 of its earnings, which have been set aside to depreciation account, to the Hawaii Telephone Company for these needed improvements. The loan is to be secured by three notes, drawing interest at 6 per cent, each for $10,000, and payable in one, two and three years.

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BY W. D. PEASLEE.

OIL SWITCHES AND CIRCUIT BREAKERS.
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WHAT IS AN ENGINEER?
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CONSTRUCTION AND MAINTENANCE OF UNDERGROUND SYSTEMS.

USE OF THE DIESEL ENGINE IN THE NAVY.
BY C. H. WOODWARD, LT. COM., U. S. N.

THE THREE TYPES OF MANAGEMENT.
BY E. ST. ELMO LEWIS.

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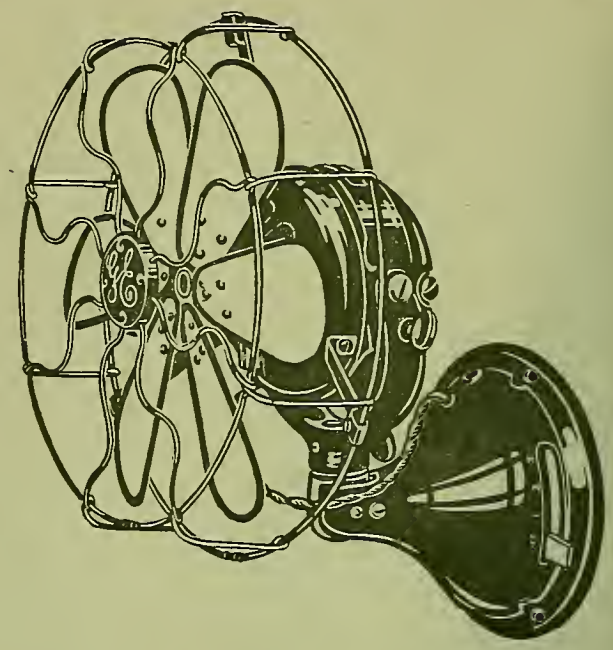
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JOURNAL OF ELECTRICITY

POWER AND GAS

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VOLUME XXXII | SAN FRANCISCO, MAY 30, 1914 | NUMBER 22

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RAIL AND STEAMSHIP TERMINAL FREIGHT HANDLING

BY W. D. PEASLEE.

(In this article the author analyzes the freight handling situation in a comprehensive manner and gives much valuable information which he has gathered for the groundwork of a proposed solution of this problem which is also carefully worked out and completely stated.—The Editors.)



From Car to Hoppers Without Manual Labor.

The growth, extent and complexity of civilization has laid greater and greater burdens on our industries, but perhaps the heaviest falls upon transportation. Cheap and rapid transportation is the index of the advance of civilization and progress for any region. The response of the men engaged in this work has been magnificent. Transcontinental railroads have been built and rebuilt almost at once; millions have been spent to save a few per cent grade and to provide heavier rails and equipment. The brains and faith of engineers and capitalists have been pitted against the forces of nature until today the cost of transporting freight by ocean is about one mill per ton, and by rail is from 2.8 to 8 mills per

ton mile. This low transportation cost has been attained by the substitution of mechanical power for man power wherever possible.

Labor in Freight Handling Comparatively High.

With this increase in economy and efficiency of the transportation systems there is one link in the chain that is practically the same as it was fifty years ago, and now represents the greatest unit tax the consumer pays for the privilege of transportation. This is the handling of freight at rail and steamship



Storage Battery Motor Truck for Freight Handling.

terminals. Here freight that has been brought across the ocean at a cost of about one mill per ton mile is handled at a labor cost varying with the kind and condition of the freight and the local terminal conditions from $.10 per ton per 100 ft. ($5.28 per ton mile) to $.70 per ton per 100 ft. ($36.96 per ton mile), by means of stevedores with hand trucks, and the steam hoists and elevators of the ship. This cost has been increasing steadily due to the increasing cost of labor and the increasing congestion of terminals which renders the worker less efficient.

The cost of re-handling miscellaneous freight by manual labor with hand trucks, varies with the local conditions from $.35 to $.95 per ton with efficient management. As all transportation problems involve at least two terminal handlings and some three or more it will be seen at once that in the average transportation the cost of handling at terminals is roughly as great as the cost of carrying it by ocean 1200 miles or by rail 400 miles.

An attempt has been made to meet the tonnage and speed requirements of the transportation systems of today by using the methods of fifty years ago on a larger scale, but the fact that there is a limit to the number of men that can work efficiently in a given space has resulted in confusion and inefficiency with its attendant excessive cost.

Tonnage Handled at Terminals.

Fifty years ago the handling of 150 tons per day at a terminal was considered a high mark while today a railway freight house in a city of 100,000 inhabitants must handle 250 to 300 tons of miscellaneous freight per day. This will be done at a cost of about $.40 per ton for labor, varying slightly with local conditions and wages paid, by means of common labor with hand trucks. The larger terminals now handle 2000 tons per day by the same method and would like to handle 6000 tons per day.

To bring terminal operations to the degree of efficiency enjoyed by the transportation systems a sweeping reorganization must be undertaken, and a part of the millions that now go into securing a fraction of a cent per ton decrease in transportation cost must be devoted to the reduction of terminal handling costs by the same method that has proved so successful in reducing costs in all modern industries, the displacing of human effort at every possible point by mechanical force and apparatus.

The Problem Analyzed.

It will be interesting to analyze the requirements of the terminal problem and to establish the main features of an ideal freight handling equipment.

The fundamental requirements of an ideal freight terminal are:

(1) A cost of handling commensurate with the present cost of hauling.

(2) Dispatch to meet the advance in speed of the hauling of increasing freight.

(3) Safety to goods handled.

The particular system that will best meet these requirements will vary with the local conditions of every terminal and can be determined only by a detail analysis of each case. In designing a terminal freight handling system some means must be available by which systems operating under different conditions and using different equipments may be compared, and their relative efficiencies established.

The four operating essentials of a perfect mechanical freight handling system are:

(1) Every foot of space in the cars, ships and terminals must be covered by the machinery.

(2) There must be a minimum freight moving by manual effort.

(3) All kinds and conditions of freight must be safely and quickly handled with equal ease.

(4) It must maintain a continuous uniform working rate, under effective and instant control.

Such an installation would handle freight with maximum dispatch and safety and least human effort but would entail enormous first cost and the operating cost, fixed charges included, would be unreasonably high. However the study of such a system is useful in that it provides a basis upon which different systems may be compared. Obviously we can never have a perfect system but comparisons may be made by investigating the deviations from the ideal met with in any particular installations.

The first requirement, while possible mechanically, is never at the present time realized on account of the first cost entailed, and a balance must be struck between the capitalized saving that will be secured with a proposed installation and the cost of the equipment necessary to secure it.

The second requirement, it is safe to say, is never satisfactorily attained. Loaders and unloaders for the freight handling machinery must be provided even if their only function is to handle slings. There are certain processes such as handling iron with magnet cranes, wherein this condition is attained but this class of freight is rarely met with in the operation of a freight terminal to any continuous degree. Checkers also are required and in many cases where the expense of replacing existing beam scales with auto-

matic scales is not justified, weighers will be required.

The third requirement may be met to a considerable degree but some kinds and conditions of freight will always handle more easily and rapidly than others from the inherent conditions of the packages. With a well designed system however this condition will be met to a remarkable degree.

The fourth condition may be met almost perfectly by careful design and operation of the system.

The points in which any system will depart from the ideal in order of their departure are:

First, that there must be a minimum of freight moving by manual effort.

Second, that the machinery must serve all the space in the cars, ships and terminal.

Third, that all sorts and conditions of freight must be handled with equal ease, dispatch and safety.

A discussion of these departures and a determination of their probable degree for different systems will give a means of comparing such systems on an equitable basis.

The Entirely Manual Method.

Probably the most complete departure from the ideal is the practice met with in Asiatic and other non-progressive countries of handling freight entirely by manual effort. From this condition successive stages are passed of adaption of mechanical aids, moving goods on inclined planes and rollers, with block and tackle, etc., until we find the popular method that has been employed for the last fifty years or more, the employment of an army of stevedores with hand trucks aided by a couple of steam winches and elevators.

As this system is the one most commonly met with, an analysis will be made of the labor necessary to move freight by this method and the probable savings that may be expected will be determined. The labor required to move freight by this method falls into five divisions.

(1) Loading trucks at the starting point.
(2) Weighing, checking and marking.
(3) Transportation on hand trucks.
(4) Unloading trucks at destination.
(5) Superintendence.

Time studies of the operations of different terminals in the United States have shown that the proportion of these divisions are about as shown in Fig. 1, for hand loading, unloading, trucking, and piling, supplemented in the case of steamship terminals by the hoists and elevators of the ships. The loading and unloading operations are not separated as the force in the cars or ship is limited by the space available and is practically constant whether loading or unloading the trucks.

By a properly designed system the trucking labor may be eliminated entirely but in some cases it will be at the expense of an increase in the loading and unloading force. It is at this point that a balance must be struck between the first cost of a system that will cover all the space, pile the freight and pick it up with the minimum labor attendance and the capitalized cost of doing part of this work by manual labor. With no provision for mechanical loading, unloading or piling this cost may be increased over that shown in Fig. 1 to about 40 per cent while with complete telepherage systems it will be reduced to about 10 per cent.

Efficiency in Weighing.

In weighing, checking and marking the only saving is found in the use of automatic scales in place of the ordinary beam scales. It has been found that it requires an average of 10 sec. to weigh a truck load of freight on automatic scales and 30 sec. to weigh it on ordinary scales. The main advantage secured by this change is in the increased rapidity of handling possible. The saving in labor will be the elimination

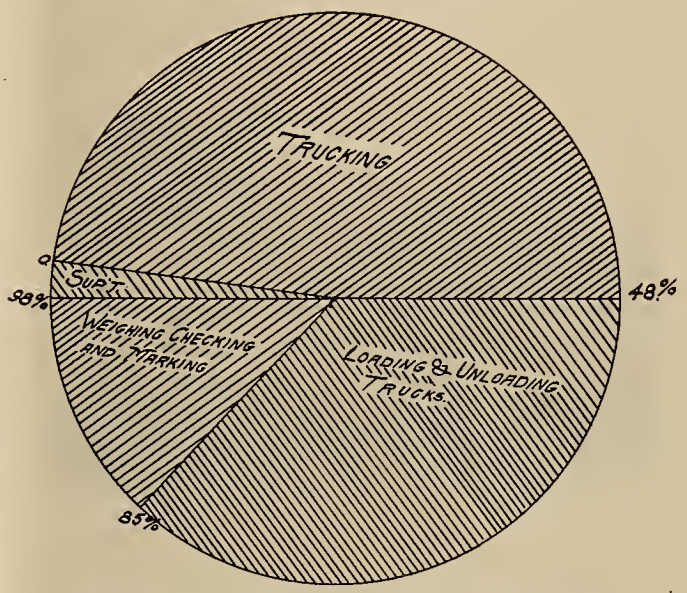


Fig. 1. Showing Division of Labor Costs in Average Terminal. Manual Trucking and Handling.

of a few weighers, amounting to about 1 per cent, but the gain in rapidity of operation and ability to maintain the higher rate of work will prove a potent factor in attaining the fourth requirement of a perfect system. The superintendence item remains the same for almost any system.

Then with the labor cost of the system represented in Fig. 1 as 100 per cent we may with a maximum investment, expect to reduce the labor cost to about 24 per cent, using a very complete transportation and mechanical piling system. With a smaller investment this labor cost will increase until with manual loading, unloading and piling, and mechanical transportation we find a labor charge running up to about 55 per cent.

To these labor charges must then be added:

The operation cost of the mechanical system, including operators, power, maintenance and interest on the investment.

Depreciation.

Taxes and insurance on the equipment.

This result will then be the handling cost upon which basis different systems may be compared.

It might be considered better to use the fundamental system wherein the handling is done entirely by manual effort as a basis but it seems more logical to use the most common and familiar system now met with, the one taken.

Equipment Available for Mechanical Method.

The standard apparatus on the market today available for building up a freight handling system is quite complete, as the following list shows, though

occasionally conditions will be found warranting the development of special apparatus, such as that shown for unloading sand, etc., and for coal, the photographs of which were furnished by the courtesy of Meese & Gottfried.

Equipment available for mechanical freight handling systems:

Portable Devices—

Slides, (Straight, spiral tubes, pipes, runs and chutes). Roller conveyors. Tractor chains, for helping trucks up steep inclines. April conveyors of wood or metal. Pumps. Scraper and bucket conveyors. Smooth belt conveyors. Hand trucks. Industrial trucks, storage battery and gas, with or without cranes. Auto trucks, gas, steam, electric and gas-electric. "Lowerators" and escalators. Stackers and "revolvators." Winches, steam, gas or electric, and portable cranes. Various special devices, car loaders and dumpers, etc.



Portable Unloader—Coal Car to Wagon.

Devices Usually Built Into and Made Part of the Terminal Building—

Gravity slides. Spiral conveyors. Blowers. Oscillating conveyors. Telepher or monorail systems. Storage battery locomotives and trailers and trackless trolleys. Cable car systems. Cranes (locomotive, driven by gas, steam, or electricity, Girder, Gantry, Pillar, Hammer head, Portal, Trolley bridges and various combinations of these types.) Elevators, steam, gas and electric. Ramps. Single and multiple drum winches.

In general two classes of terminal problems will be met with infinite variety in each. In one case the freight handling equipment is designed as a part of a new terminal building before construction and the architectural and freight handling features may be designed as a unit. In such cases the selection may be made on the basis of the most suitable machinery unaffected by structural limitations of the building.

In the other case the condition most met with at present, the terminal building is already in place and any material changes will entail considerable capital outlay. In this case the closest analysis is required and a compromise between efficiency of the freight handling equipment and first cost is the result. Fortunately even under these conditions actual installations show that a saving in handling costs of 20 to 40 per cent may be realized and that this saving represents a return on the necessary investment of from 40 to 250 per cent per annum according to the particular conditions met.

It will be seen at once that handling devices of the more portable type lend themselves most readily to an installation of this type as built-in equipment entails too much reconstruction of the existing buildings. To show the possibilities of a mechanical freight handling system installed in an existing building over the manual loading, unloading, trucking, and piling system the study of a particular case will be outlined.

[To be continued.]

OIL SWITCHES AND CIRCUIT BREAKERS.

BY FORD W. HARRIS.

(Out of a wide experience the author discusses the requirements of oil switches and circuit breakers and also analyses the causes of failure which are fully stated.—The Editors.)

Considering the large number in operation, the large amounts of money invested therein, their nearly universal distribution, and the many types manufactured, it is somewhat surprising that there has not been more written on the theory of the oil switch and circuit breaker. This is partly due to the fact that their manufacture has been restricted to a few companies, but more so that the engineers who were closest to the problem were not in agreement as to the theory or indeed as to the facts on which any such theory could be based. It is only quite recently that the oscillograph has been applied to the study of such problems and without some such instrument only a very elemental knowledge of the problem was possible.

A considerable amount of experimental data has been collected and it is now possible to speak with some authority on the subject. This knowledge is fairly widely distributed and I will therefore only attempt to point out in a general way the facts as I know them, and the inferences that I personally draw from such facts. These facts are the result of several years experience on this work and have been obtained from a large number of different tests at widely separated points both in space and time. They have ranged from what might be termed laboratory experiments involving small switches on moderate voltages to tests on some of the largest power houses in the country at currents and voltages that approach the limit even for this country. In addition to actual tests there is a large record of failures of oil breakers to draw on and scarcely an operating man in charge of large power plants but has had some such experiences.

The problem of opening the circuit promptly and quietly has grown with the size of stations. It is now and has always been easy to open shorts on stations of 5000 kw. and below and even stations of twice this capacity, with favorable conditions in other respects, are operating satisfactorily today with more or less obsolete breaking equipment. When, however, much larger stock of power began to be tied to lines of low impedance the problem became a serious one. The coming of the modern low impedance steam turbine with its large stored energy further aggravated the problem.

Heavy shorts are of rare occurrence on well designed and erected systems and it took a large number of cases extending over a considerable period of time to arouse the big operators and manufacturers to the gravity of the problem. The few cases that occurred previous to 1907 were assumed to be the fault of poor operation or accident and the big operators themselves shared this view with but few exceptions. The oil switch operates so quietly on moderate overloads that it had built up for itself a good reputation and those responsible for it felt it to be a satisfactory device. Further it was as good as they knew how to build it and therefore stood pat

for a much longer period than the gravity of the case should have permitted.

The results of this delay are no secret and the large manufacturers are today fully alive to the importance of the problem. There can be no question that they are all in a position today to handle heavy switching problems efficiently and this paper is not intended to in any way imply that such is not the case. It is simply a recapitulation and a restatement of facts that are well known to a few and which should be generally understood by the profession.

The earliest indication of strain that oil switches showed was a tendency to throw oil. This is an old symptom of trouble and has never been regarded with alarm so long as there were no other and more serious complications attending it. It has been the practice in some stations for many years to examine and, to some extent, repair the main switches whenever they were called upon to open heavy shorts. This involved extra switches and some expense but such shorts were of so rare occurrence that this did not impose a very great tax on the station, and operators were willing to do it although some of them "growled" a little. This throwing of oil was the first indication that the switches were under a strain that they could not satisfactorily meet, and indicated that as stations increased in size something would have to be done.

If you will examine the published material relating to the pioneer work on the single-phase railway system you will see that there is frequent reference to switch trouble and it is therefore violating no confidence to say that there was a considerable amount of such trouble in the early days. The able work done by the officials of the N. Y., N. H. & H. R. R., and particularly of Mr. Murray in conjunction with the engineers of the manufacturing company involved, have made ancient history of these troubles. That railroad is now running so successfully that any such mention is in the nature of a compliment on the efficiency of all parties concerned.

That system, as originally installed, consisted of an 11,000 volt station connected directly to an extensive overhead construction that was somewhat experimental and which proved to be somewhat low in its factor of safety. On a pioneer installation, of its class, this could be expected. The overhead was supported by steel bridges and beneath it there was a heavy traffic not only of electric rolling stock but of steam locomotives as well. The other side of the system was solidly grounded and there was but little impedance. The heavy traffic made repairs and maintenance difficult and there resulted a period that has been described often by the enemies of the single-phase system, as characteristic of such. That this is not the case is abundantly shown by later experience.

Temporarily, however, there were a great number of heavy short circuits. These threw a heavy strain on the switches and an epidemic of switch trouble resulted. The men who solved that problem have reason to be proud of their achievement for solved it was and completely so. A short on that system today is a frequent occurrence due to the multiplicity of overhead but it is merely an incident and does not in any way interfere with the operation of the road except as it may incapacitate a single unit, and even this circumstance is rare. The switches and the system recover instantly from such a short and power is maintained on the lines while this is being done. The section of overhead and the train unit affected are isolated at once and the rest of the system scarcely experiences the disturbance. Indeed, in most cases the affected parts are at once put back into service and in a majority of cases they are found to be perfectly operative. Many of the cases of troubles burn themselves clear or consist of open air arcs that will not restart when once interrupted.

The trouble at this installation was solved by an evasion. The problem was somewhat simplified by the fact that there was practically but one feeder to protect and if a single circuit breaker could be devised that would handle the output of the station at all times of normal load and overload the difficulty would be overcome. A breaker was devised with this in mind, and still stands between the line and the power house fully protecting the system. It is a somewhat expensive and complicated device housed in a small building, and it consists primarily of a large resistance capable of taking the full output of the station for some seconds. This resistance is gradually cut in when a short occurs and before the line current in the damaged section is interrupted. With this resistance all cut in, the line current is reduced to about 2500 amp., and this current is well within the capacity of even the smallest and cheapest switches to open. Certain other incidental advantages were obtained but they are outside the scope of this paper.

It was appreciated that the solution at this installation while a neat one, would not be applicable to stations with a multiplicity of feeders on account of the complication and expense and that a more general solution would have to be found. It was also appreciated that no more laboratory experiments would be sufficient and that some one would have to take some chances and wilfully short circuit some big power houses in the presence of an oscillograph. That there were found operators that were willing to do this speaks well for the broadmindedness of the men engaged in this work. The results of a short circuit are often so appalling that it would have been entirely reasonable for operators to absolutely refuse to put their stations to any such use. It was appreciated that it would be impossible to ever make material progress in the art unless such chances were taken and operators were located who were willing to endure under predetermined conditions what they often had to without notice and under conditions that they could not control. With the necessary equipment of breakers and oscillographs, a number of tests were run.

The general method of making these tests is also generally understood. The circuit breaker to be tested is closed on a short circuit. The ammeter element of the oscillograph is put in series with the short and the voltage element is connected across the terminals of the breaker. An electrically operated switch is connected in series with the breaker to be tested and is left open until the test is actually made. It is evident that there will be neither current nor voltage in the oscillograph with the switch open but as soon as it is closed a heavy current will flow and there will be a slight voltage due to the drop through the short circuit and the breaker to be tested. As soon

as the circuit is opened by the breaker there is full voltage across the terminals of the oscillograph element and if the circuit is opened at any other point there will be no voltage. This permits assurance that there will be no mistake about the circuit being opened by this breaker. A connection is then made so that the shutter of the oscillograph will be opened by the closing of the switch. In dealing with heavy currents shunts and transformers are used to reduce the current and voltage in the oscillograph elements to usable values.

Everything being ready the operator signals for a short and closes the switch. The breaker being closed, the switch is then closed this opening the oscillograph shutter just before the contacts come together. This is always desirable but not always possible and in case the circuit is made a little before the shutter is opened the current line will start out at a maximum value in the place of zero. The first one or two current waves are generally somewhat distorted and magnified and the current on a heavy overload for the machines starts to decrease, each successive wave being slightly smaller than the preceding one. There follows the opening of the shutter and the closing of the circuit an interval during which the various mechanism involved is getting under way. Relays have to act and the natural inertia of all the mechanism involved has to be overcome. This usually takes about one-half second on the general types of breaker now in service. The duration of the arc is usually quite small, it lasting in most cases only a fraction of one alternation. Following this arcing period there is a short interval during which the voltage is normal followed by a closing of the shutter.

By means of two three element oscillographs it is possible to record the voltage and current on all three phases but such an arrangement is rarely of any considerable value. After seeing the results of many tests the following conclusions seem to be true.

(a) In most cases of what may be termed normal operation the current line does not cross the zero line after the contacts start to separate. Even under these conditions the breaker may show considerable distress, throwing oil and emitting smoke (I have not had an opportunity to see tests on voltages above fifty thousand with heavy currents and I cannot say positively that on these higher values the current does not restart but on voltages below this I am satisfied that the normal condition is that of a rectifier the current falling to zero with little or no distortion and not restarting.)

(b) That the voltage across the arc is always low indicating that the arc path is of very low resistance. With a line voltage of 11,000 the combined drop across two arc paths is generally below one thousand volts.

These two conclusions explain much of the phenomena noticed in connection with such tests. We have a low voltage high current arc that starts sometime during a current wave and falls to zero following the natural shape of the current wave. Since the voltage across the arc is small the amount of energy in an alternation or part of an alternation is small. This energy is expended in heating the contacts and vaporizing them and in heating and vaporizing the oil. The critical moment comes when the current reaches zero and starts to reverse. The contacts have separated a little and the space between is filled with a mixture of gas and oil. The current is zero and it must start by jumping across this gap. At a certain critical value of gas it will do so. Having once established itself it will generally have an easier time at the next zero point as while the contacts have separated a little more there has been a full alternation during which the accumulation of gas has been relatively more rapid. It is far from proved but it is my belief that if a breaker holds over for one alternation that it will hold over for several with more or less disastrous results.

These will vary from a vigorous spurt of oil to a complete destruction of the apparatus. That heavy pressures occur is proved by the heights to which oil is thrown and the distortion of heavy tanks that accompany such explosions. Large variations are often observed in the performance of similar breakers under what appear to be similar conditions. This is due partly to the fact that the actual opening of the contacts in one case starts soon after the current begins to rise and there results a full alternation during which the arc persists and in the next case that the arc is started low down on the current wave just before it reaches zero and the time and energy involved are materially less.

Having in mind this theory of the action of the circuit breaker it will be profitable to examine the various ways in which it has appeared likely that the action of such devices could be improved. These are as follows:

(1) Mechanical displacement of the arc. One of the oldest ways of extinguishing a flame is to blow it out and the general plan of blowing air across an arc has been used many times with excellent results. It would seem that it would be an excellent way to extinguish an electric arc. It will extinguish an arc and compared with the alternative of letting the arc "hang on," it is efficient. But it is immeasurably slow when compared to the rectifier action of an oil breaker. There have been numerous patents granted on the general principle of wiping an arc out by fanning or forcing oil across the contacts. They are, so far as I am familiar with them useless. The time involved in the action of a circuit breaker is so short that any such movement becomes more or less microscopic in that time. The general plan of forcing oil under pressure through the arc path has been a favorite scheme and tests have been made where a breaker was equipped with nozzles of various types and a stream of cold oil under pressure was forced violently across the path of the arc. A good sized pump furnished the oil and the result was absolutely conclusive. The breaker threw as much oil and made as much smoke with the oil jets as it did without them and no difference in the shape of the oscillograph curves could be noticed.

In the same class come the various directions of break. It is claimed that a horizontal or an upward vertical break is superior to a downward vertical break on account of the better characteristics. It is claimed that the natural movement of the oil assists the break in these cases. There are some reasons for a preference in regard to the direction of break but so far as the ability to open the circuit is concerned there is but little difference. The contacts

separate a short distance and the arc goes out in so short a time that there can be no material movement of the oil body. If the arc is going to persist for so long a time that the gases are going to have a chance to move any great distance the amount of energy involved will be great enough to blow the oil out of the tanks entirely and such a movement is of no value.

(2) Magnetic displacement of the arc. There exists a well defined magnetic blowout effect due to the distribution of the magnetic flux linked with the breaker and the design should be such that full advantage should be taken of this point. The vapor path has little weight and comparatively small forces will accelerate it rapidly. It should be borne in mind however, that the efficiency of a magnetic blowout in oil is much less than the same blowout in air as the oil dampens the movement of the gases. The commonest application of this magnetic blowout principle has been worked out on railway apparatus and there again it is more efficient, as we have a continuous flux and a continuous current and there is not the intermittent and sometimes conflicting condition that an alternating arc offers. Also by using suitable iron circuits the flux can be concentrated and directed so that it acts with great efficiency. All things considered the magnetic blowout effect is much less valuable than has often been assumed and one should not hesitate to sacrifice it if other great advantages could be gained thereby.

(3) Quicker breaks. At first sight it would seem advisable to have a breaker open as quick as it is physically possible to do so. This subject is somewhat obscured by a little ambiguity as to what we mean by "open." There is first the interval of one-half second during which we are waiting for the various mechanism to get to the actual point where the contacts separate and secondly we have the time during which the contacts are actually separating and the arc is persisting. We can lengthen the first period indefinitely by the use of time element relays but the second period depends almost wholly on the frequency of the circuit and the more or less accidental relation of the instant of separation of the contacts and the value of the current wave at that instant. There can be no question as to the desirability from a circuit breaker point of view of lengthening the first period. The longer we can delay the moment that the breaker has actually to take the arc the better chance it has. The generator is losing its field due to the armature reaction. The prime mover is slowing down and everything is getting hot and the resistance is rising. It is common practice to put in cheap breakers and give them a 4 sec. time element so that they will benefit by all these factors. This theory carried to its logical extreme results in non-automatic switches or circuit breakers with an infinite time element. This is an evasion, and given a circuit breaker that will stand the strain, it is advisable to get the circuit open as soon as possible. A quicker mechanical movement of the circuit breaking parts will result in this but there will also result a longer arc path being drawn out in the alternation that ensues before the current has a chance to reach its natural zero. This is advisable in that it will result in a longer path to resist the restarting of the arc. Suppose however, that we already have a long enough path to stop the current. In this case all that a longer path will give us is more gas. That is the longer path will have a higher resistance and consequently more energy to dissipate in vaporizing oil. Remember that the resistance and the voltage across even quite long paths, say 6 in. is very low and that the effect in reducing the current due to this resistance is small. It is evident that when we start drawing an arc longer than that needed for the purpose of preventing restarting that we are actually putting more strain on our breaker without additional gains to compensate for it. An attempt was made to find out what effect quicker breaks would have on a 6600 volt breaker working on about 3000 amp. overload. A heavy weight was dropped from heights up to 20 ft. on a pair of contacts thus violently jerking them open. Various heights were tried and the oscillograph indicated that there was no great difference in the wave form due to the various heights. In one case the weight falling from a height of about 16 ft. rebounded and let the contacts close again so that we had on the same film one record that represented a very quick break and a second record of the second break due to the weight pushing the contacts apart at a slow rate. The two records were practically identical showing that very little good was accomplished by the quicker break.

It is hard to make a definite statement on this point but it seems to me that we could gain by increasing our speeds somewhat especially in the larger breakers and in those opening high voltages. For 11,000 volts and below I do not think that more speed will be of much value.

(4) Resistance insertion. The Long Island Station of the Pennsylvania railroad has seven breakers that insert resistance before they open the circuit. These breakers were adopted after severe tests had proved that they were a step in advance of any then existing breaker. They were an attempt to incorporate in a small space the principle that made the N. Y. N. H. & H. R. R. installation a success. The above company had a station completed and the space provided for standard breakers before it was decided to adopt this type and the design was naturally very difficult and the parts very much crowded so that this cannot be regarded as a real test of the possibilities of this breaker. Some designs have since been proposed where a reactance is inserted either in one or several steps before the circuit is actually broken. Tests show that these breakers function better than the standard types now in service and there will doubtless be some development along these lines. These breakers, however, are not the final answer. To understand this statement it will be necessary to consider the action of such devices at some length.

[To be continued.]

Machinery Hall is the largest exhibit building at the P. P. I. E. and this points to the significance of the era following the opening of the canal as one of intense industrial development on the Pacific Coast. It also emphasizes the policy of the exposition officials to give precedence to whatever will add to the educational value of this Exposition and the selective rather than collective gathering of exhibits.

WHAT IS AN ENGINEER?

BY ARTHUR A. NOYES.

(Address delivered recently before the Throop Assembly by Dr. Noyes, who is Director of Research Laboratory of Physical Chemistry ot the Massachusetts Institute of Technology, and Professor of General Chemistry at Throop College of Technology. —The Editors.)

When President Scherer invited me to speak to you, the best subject that I could choose, since you are all to be engineers, seemed to be: "What is an Engineer? What are his opportunities and functions, and how can the student of engineering best prepare himself for engineering work of the highest type?" For it is important to have the goal constantly in sight so that he may work directly towards it.

What, then, are the functions of engineers of the highest type? We may answer, I think, that they are to be the leaders in the scientific development of the commercial and industrial enterprises of the country. They are to apply scientific knowledge to the arts. Engineers are not skilled artisans who have mastered the technical methods of the arts. They are not machinists, electricians, draftsmen, or chemical analysts—men who do the routine work of industry; but they are the men who install new plants, build new structures, improve existing processes, and develop new ones. It is true the engineer must acquire the technique of his profession. He must measure accurately, draw clearly and neatly, and analyze with absolute certainty. Yet these are incidental accomplishments, not the main powers which the engineer must develop; and it is a real danger in technological education, where much time has to be given to acquiring manipulative methods and technical knowledge, that the student will come to regard these as the main purpose of his education. There is danger that he will not "see the woods because of the trees."

Far more important than mechanical technique is, of course, a good knowledge of the underlying principles of engineering science. This implies a thorough training in the sciences of physics, chemistry and mathematics; for these form the backbone of the science of engineering. Engineering as a science is nothing but applied physics and chemistry—applied with the aid of the exact methods of mathematics. Physics is the science that deals with forces and with energy transformations, mechanical, electrical, and thermal; and it is with these very things that the engineer has to deal. Professor Pupin, the physicist who has contributed so much to the advance of electrical engineering, has given an interesting definition of the civil and mechanical engineer. He has defined a civil engineer as a man who makes things stand, and a mechanical engineer or electrical engineer as a man who makes things go. When a civil engineer builds a bridge he wants it to stand where he puts it; he does not want it to go anywhere. It must stand in opposition to various forces—that of its own weight, the force of moving water, the force of wind, etc., all of which are subject to the laws of physics. When a mechanical engineer, on the other hand, builds a machine, he wants it to go, not to stand still; and in order that it may go successfully, he must devise machines for transforming and transmitting energy of various forms. But these energy transformations constitute the most fundamental subject with which physics has to deal. In his structures, moreover, the engineer must use a variety of materials—wood, stone, iron and steel, cement, mortar, asphalt, paints, etc., all of which form part of the subject matter of chemistry, which may well be defined in a somewhat popular way as the science of materials and of their transformations into one another. Perhaps I may cite one or two instances of the importance of chemical knowledge to the engineer. Such are the prevention of chemical corrosion by air and water, for example, of steel and concrete structures and of boilers, thereby avoiding losses of many thousands of dollars; the production of car wheels and steel rails of such composition and texture that their permanence can be relied upon; the production of new steels and other alloys for various constructional purposes, tools, etc.; and the production and refining of fuels, and the study of conditions insuring their complete combustion.

The bearing of all this is to show you the importance of doing thorough work in the courses in physics, chemistry, and mathematics, so that you may have the fundamental scientific basis for your engineering work. Remember, too, that in engineering subjects themselves it is the principles rather than specific industrial applications or technical methods that you need to get here at college. The details of engineering practice you will more readily and more satisfactorily acquire when you enter upon the work of your profession. Remember that a knowledge of theories is especially likely to be of value. In scientific usage the term "theory" is not contrasted with practice as it is apt to be in every-day language. In science a theory means a body of knowledge derived from or based upon fundamental principles; and it is more important to know principles than facts, because a principle embraces a multitude of facts.

It is true that no less important than the possession of this fundamental knowledge is the power to apply it. Your employer will be interested not in what you know, but in what you can do. The other thing besides fundamental knowledge which you must acquire at college is therefore the power to apply it, and it is natural to ask how this power may be best acquired. It can certainly not be gained by doing your daily work in schoolboy fashion, by memorizing the lessons, or cramming for examinations. The student must not simply learn, he must understand and think about his work. It is better to do half of it understandingly than to cover the whole ground superficially. Of especial importance in developing the power I have referred to is the independent solution of the numerous problems which constitute a large part of the work of any good engineering school. Bear in mind that the main purpose of such problems is not to teach how to do the specific problem that may be given out, but to gain the power of solving any problem of the kinds that will be presented to you in your subsequent engineering practice. Very little good will therefore come from studying problems which have already been solved by the instructor, or from copying them from other students.

But there is another side to engineering education. After you have learned the science of engi-

neering you are to practice the art of engineering. This means that you are to be not only men of science, but men of affairs, men with large responsibilites, men who have to deal effectively with other men. There is thus an important human element in the work of the engineer. A member of one of the largest engineering firms in this country recently said to me, "When I want a man to deal with things I employ a graduate of an engineering school, but when I want a man to deal with men I prefer a graduate of an academic college." In so far as there is truth in this remark it shows to us a danger in technological education—a danger against which we teachers and students must guard; for it is those that combine the power of dealing with things with the power of dealing with men that secure the positions of highest responsibility. The scientific training of engineering schools has many advantages over the general training of the academic colleges. It is thorough and intensive, while that of the college is apt to be superficial and desultory. It has a definite, practical end in view, which insures the interest and close application of the student. It teaches him to think clearly—to analyze a problem and grasp its essential features. It teaches him to work hard; and it is a tremendous asset in life to have learned to work in early life. In brief, it develops those qualities whose importance is so well expressed by the psychologist, William James, in his great essay on "Habits," in which he says, "The man who has inured himself to habits of concentrated attention, energetic exercise of will, and self-denial in unnecessary things, will stand like a tower when everything rocks around him and when his softer fellow mortals are winnowed like chaff in the blast."

But with all these advantages there go certain dangers—especially the danger that the engineering student will become only a narrow specialist, instead of a broadminded man of affairs. The engineer has constant occasion to deal with men of all types—men both in positions superior and subordinate to his own—and he must acquire that breadth of view and breadth of knowledge which will make him appreciated by, and appreciative of, men who have had a different training. He must learn to know and to value the activities of life that lie outside his own professional field—those things in which other men are interested. He must appreciate the various kinds of literature and the various forms of art—music, drama, painting. He must take an interest in the political, social, and industrial questions of the day which form ordinary subjects of discussion among educated men. Of special importance to him will be the power to write and speak convincingly, if he is to make the results of his work effective, get his ideas realized, and his plans adopted. As engineers you will be constantly called upon to make reports, and if such reports are to serve their purpose, you must, as one of our Technology professors has recently said to his classes, "Write them concisely, else no one will read them; clearly, else no one will understand them; and convincingly, else you might as well not have written them."

It is fortunate that you are studying in an engineering school where the importance of this liberal side of education is fully appreciated—in a school whose trustees are men of large affairs in many different lines, and whose faculty has been gathered from all types of institutions from all over this country. In consequence, the curriculum of the engineering courses of this school is one of the broadest and most liberal of any in the country. Yet the main factor determining the success of any system of education is the spirit in which its students approach it; and the existence of these liberal studies in the curriculum will avail little, if you do not approach them in the same earnest spirit and with the same interest which you give to your professional subjects. Remember that you are spending here four of the best years of your life at a large expense of time and money, and that you will not get out of it your time's worth and your money's worth, if, for the sake of the purely professional subjects, you neglect the liberal studies in literature, foreign languages, history, politics, and economics, or the fundamental scientific studies of physics, chemistry and mathematics. If, on the other hand, you make the most of all these opportunities you may be sure that you will be well fitted to fulfill the ideal expressed in the closing words of our own Technology song:

"Each man in his chosen place
Beats out on the anvil of human toil
The good of the human race."

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY.

Annual Report, 1914.

The board of directors has presented the following report of the operations of the company and its subsidiary companies for the fiscal year ending March 31, 1914:

The income account for the year was as follows:

Gross Earnings—		
Sales billed		$43,733,645.77
Cost of Sales—		
Factory cost, including all expenditures for patterns, dies, new small tools and other betterments and extensions; also depreciations of property and plant, inventory adjustments and all selling, administration, general and development expenses		39,016,423.39
Net Manufacturing Profit		$ 4,717,222.38
Other Income—		
Interest and discount	$ 454,998.94	
Dividends and interest on Sundry stocks and bonds owned	718,282.12	
Miscellaneous—Royalties, etc.	107,574.76	1,280,855.82
Gross Income From All Sources		$ 5,998,078.20
Deductions From Income—		
Interest on bonds and debentures	$1,042,101.53	
Interest on collateral notes	591,259.68	
Interest on long term notes and mortgages	72,554.06	
Proportion of expenses incidental to bond and note issues	133,750.00	
Miscellaneous	99,514.21	1,939,269.48
Net Income Available for Dividends and Other Purposes		$ 4,058,808.72

The sales billed and net income for the year are both in excess of the previous year. The ratio of manufacturing profit to sales billed decreased due to severe competition and to depreciation charges which were this year included in cost of sales. Last year depreciation charges were deducted from income.

The value of unfilled orders on March 31, 1913, was $12,061,473; on March 31, 1914, the value of unfilled orders was $7,951,385. The average number of employes during the year was 18,635 as compared with an average of 20,542 for the previous year.

ELECTRICAL DISTRIBUTION

CONSTRUCTION AND MAINTENANCE OF UNDERGROUND SYSTEMS.

(The following recommendations which have just been published by the Oregon Railroad Commission, are considered unique, and should prove invaluable to operating companies. They were born of necessity and Oregon power companies were called into consultation during their compilation.—The Editors.)

Printed Rules; Compilation and Distribution.

Printed rules shall be prepared by each utility and a sufficient number of copies issued that each employe who may at any time be called upon, in any manner, to do underground work or supervise same, shall be provided with a copy of said rules.

A record shall be maintained in the Territorial District, division or general office of each utility, as the case may be, of the signatures of all employes so provided with copies of these printed rules, such employe's signature being an acknowledgment of service of said rules by the utility for whom he may be employed.

Protection Against Accidents.

At all times during the progress of work in manholes, when workmen are in the manholes, or during the period when covers are removed therefrom, a competent workman shall be stationed as a guard or watchman, on the ground above, at or near the entrance to said manhole, and such workman shall at all times be in a position to supervise the immediate vicinity of said manhole and shall be so located as to have the manhole barricade and the immediate surroundings within his clear vision.

A barricade shall be maintained around the opening to the manhole and be of such type as to furnish ample protection against accidents at all times during the progress of work therein. There shall be displayed from the top of such barricade, at a distance of not less than 5 ft. from the ground, a red flag of dimensions not less than 10x15 in.; and said flag shall be in such a position as to be in full line of vision from all directions. In addition thereto, from dusk until daylight the following morning, red lights shall be maintained in such positions as to warn the public approaching in any direction.

The regular manhole cover shall be replaced on same during all periods that workmen are not on duty.

Fire and Gas.

It shall be the first duty of all workmen opening and entering manholes to first carefully inspect for gases, and under no circumstances shall a light of any description whatsoever be allowed to enter the manhole until it has been positively ascertained that gases do not exist therein.

In such cases as it is found necessary to use a blow-torch in wiping joints, inspection for gas shall be made immediately prior to the introduction of the lighted torch in the manhole. During such period as the workman shall be using a lighted torch or fire of any description therein, the guard above ground shall be at the upper entrance to the manhole.

Smoking in manholes or at the opening thereof shall be positively prohibited at all times.

Under no circumstances shall a fire be maintained for the purpose of furnishing warmth for the workmen in the manhole, or within a distance of 10 ft. from the opening to manhole.

In all cases where it is possible, electric light shall be furnished. Where impossible to furnish electric lights, acetylene gas burners shall be maintained; the tank furnishing the gas shall at all times be located above the ground and the gas burners supplied by means of rubber tubing. Lanterns and candles should be used in manholes only in cases of absolute emergency, when making the initial inspection in cases of trouble, and when it is impossible or impracticable to secure such electric or gas lights as above prescribed.

Heating of Wax or Metal.

At no time shall wax, compound, paraffine, metal, or any other substance be heated within 10 ft. of the manhole opening. The furnaces or fire-pot for heating same shall also be maintained at a distance not less than 10 ft. from the opening of said manhole.

Covered vessels containing heated paraffine, wax or compound shall never be lowered into a manhole. The cover shall be removed from the vessel not less than 10 ft. from the manhole opening.

Protection to Service.

Splices in a temporary condition shall be allowed to remain in such manner only the least possible time, and shall be provided with such insulation as is common practice, and in so far as possible provide protection against moisture entering same.

In all cases the cable or cables should be returned to normal condition at the earliest possible moment, and if service be affected the work should be continuous to the end of restoring service to all patrons.

Cleaning Manholes.

All debris, such as paper, insulated ends of wire, rubber insulating matter, or any other substances of an inflammable nature, shall be removed at least once a day during the progress of the work.

The manhole shall be thoroughly cleaned of all debris upon the completion of each piece of work. A regular inspection of all manholes and cleaning of same shall be made in the spring and fall of each year.

Extent of Application of Preceding Rules.

Such rules or practices as may be in effect or employed by the utility, not in opposition to the above, shall in no wise be affected or altered by these rules.

Observance of the foregoing standards is recommended by the commission to all utilities, from the dual considerations of safety and efficiency of service. It is not deemed necessary, at the present time, to institute formal proceedings looking toward the issuance of any formal order in the premises, but such course will be followed in the event that standards of construction and maintenance are not voluntarily made such as to secure the utmost efficiency and safety in service.

SELLING ELECTRIC SERVICE

THE THREE TYPES OF MANAGEMENT.

BY E. ST. ELMO LEWIS.

(The first of a series of three articles on the subject of Management. The author is president Detroit Executive's Club; first vice-president National Association Corporation Schools, and advertising manager Burroughs Adding Machine Company. The Editors.)

Strenuous or Rule-of-Thumb Management.

It is important for us to recognize in the very beginning of any consideration of the question of costs, that a cost system does not unfold itself as a logical consequence of starting a business with a bookkeeping department. A cost department is an entirely different unit. A cost system is not based upon the pre-determined scheme of things which flow from one to another in an inevitable and logical sequence. A cost system is the reflection of a man's mind, of his manner of thought, of his education, of his sympathy, of his training and experience, of his ability to manage, to analyze, to synthesize, to coordinate, to harmonize, to grasp things in detail and in the large. We understand that cost keeping at its best is an efficient method of determining exactly what time, work, and material is put into the production of any marketable energy, commodity, or service.

Do not make the mistake of thinking that manufacturing is limited to things that you can weigh on scales or measure with a foot rule. The electric light company manufactures a product as well as the automobile manufacturer. The railroad company manufacturers a product as well as the sugar refinery. The banker manufactures a product as well as the hat manufacturer. The department store manufactures a product, and so does the doctor, the lawyer and the advertising manager.

The mere fact that in some of these a definite standard of measurement has not been obtained, does not preclude the idea that their work can and must be measured and its value approximated. Therefore, no man should adopt the attitude that they can't be measured. Some people think that advertising can't be measured. This is not because it can't be measured—it is because their education, their experience has not progressed far enough to give them the ability to measure it. The savage seeing the lightning in the sky would probably find it possible to imagine that the electric fluid could ever be measured, but it is being measured. The main purpose of any cost-keeping system is to find measures for many things that can not be measured by the ordinary bookkeeping processes, or by the mere senses of careful foremen, and thereby arrive at standards of usefulness and value and determine relative costs of production for guidance in forming policies.

If a cost system is a reflection of a man's mind, or of the minds of a number of men, it becomes very important to find out what kind of men they are.

There are three fundamental types of men in the world. There is the Strenuous type, the Systematic type and the Efficient type. These types fall into divisions, determined by the methods they use and all of their mental and physical equipment. All these types are reflected in cost keeping systems. The strenuous man, for instance, is the hard working type. He may be called the "sweat" type. His philosophy in life is embodied in do it now. He is a doer worker of muscular type. We have had thousands of them in our factories as managers. They are busy—busy-ness is business with them. They are the men who get down to the office at six o'clock in the morning and work until ten o'clock at night. They never think of the factory hygiene, of lighting, of plant planning, of functionalizing, of standards, of education. Their ideal is hard work. They take literally the proposition that man must gain his livelihood by the sweat of his brow. When everybody worked that way, of course, strenuosity was the order of the day. It didn't make any difference—the world was on a sweat basis. Then the man who was the most strenuous, made the most money in feeding a hungry market. It was a brute force—physical stamina that won. One unskilled laborer was so good as any other unskilled laborer. But when skill came into competition with the man at the bench; when brain, forethought, planning and thinking came into competition with the strenuous manager, then came the demand for protection, and the outcry against competition.

The purely strenuous type can be seen in a bookkeeper who works hard, who is loyal, but who fusses and fiddles over things, but the rule-of-thumb or strenuous man is the type that believes if he lowers his cost each month or each year, he has gained highest efficiency.

He maintains that his business is different from any other business. He thinks the only thing worth taking from anybody else is to steal a patent, or to steal a man who has shown that he can do more than anybody else.

The rule-of-thumb man says "each man is different," that "you can't teach salesmen," that this man who is doing things so successfully has an unusual faculty possessed by nobody else.

His apprentices "learn by doing" (the good and the bad things); he hasn't any school of workmen (they already know). A school for teaching salesmanship would make him laugh—and yet he is buying his cash registers, his adding machines, his insurance policies and his loose-leaf devices, if he has any, from salesmen who have been taught in schools how to sell the produce to just such a man as he.

The rule-of-thumb man never joins business organizations except to be a good fellow—he never makes a research to find out new things—he calls it "high-brow theory." You can't tell the rule-of-thumb man anything, because you cant' tell any man anything that he doesn't know.

The rule-of-thumb farmer plants by the almanac and reaps by the grace of God.

The rule-of-thumb mechanic has learned his good and bad methods by the side of an older mechanic, who learned his good and bad methods from another. Each loses a certain amount of efficiency in the process of learning. He doesn't study trigonom-

etry or geometry. He doesn't care anything about such "high-brow stuff," but he is a loyal member of his organization and talks against capitalists "who don't do anything."

The rule-of-thumb employer cares nothing for co-operation. He sees nothing but competition. The only kind of organization he wants to belong to is an anti-union organization. He is an anti-laborer; he believes that you have to use the big stick, that you have to drive men instead of lead them because, "Well, you see, that's the way it always has been done, and my father did it that way."

The rule-of-thumb banker, the rule-of-thumb retailer—all of them have ingrowing businesses because their education has never gone beyond the confines of their own particular experience.

They can imitate, but they can't adapt.

They don't really think about their business—they only think about the dollars and cents.

They don't think about men, but they think about machines.

Their costs are necessarily nothing but approximations, more or less distant, of an ideal set by the men who have worked under different conditions of a more or less distant past.

In such a plant you see do it now signs all over the place. In such places salaries are raised by the time clock and calendar. Such a manager has no methods of measuring men's efficiencies because he doesn't know what those efficiencies are.

His ideal of a cost system is a crude method by which the piece workers can be prevented from getting more than he thinks they are worth. He says no laborer is worth more than $2 a day because that's all he has ever paid, and he is perfectly satisfied if a salesman increases his business 10 per cent a year in his territory. If his competitor lowers prices, he wonders where his competitors "steal" the raw material. "How long can he continue to lose money?" It never occurred to him that a man can beat him at his own game and make a fortune in the process.

He doesn't analyze his business and its possibilities to find out the real reason for his success or failure. He hasn't time. He is "too busy doing things."

In the hiring of people, his ideal is to "try them out—see what they can do." The try and fail method is a gospel to him. He solemnly asserts that "you can't tell what any man is able to do." "That other concerns are foretelling and finding out what types of men are necessary for certain jobs, are pre-determining what men will fit the jobs and then getting the men to fit the jobs, is a joke to him.

Of course you can't tell him anything about it because he doesn't know anything about it.

He doesn't know anything about the idea because he has never seen it at work. If he did see it, he would probably dismiss it with—"The employment manager was better than usual"; but as for finding law or principle in any course of action, he dismisses it with, "It is the man who is doing the work, and the man who is getting the results."

The rule-of-thumb manager prides himself upon "knowing his business." He never thinks of using outside counsel. If a man would suggest to this type of mind that there is a better way in which to grind a valve, his first question would be, "how many valves have you ground?" In other words, his attitude of mind is of the man looking in the mirror when he is looking for all the reason for success.

It is a type of mind of which we have had entirely too many, and which competition and the efficiency of skilled minds, applied to skilled work, is gradually forcing out of American business. These rule-of-thumb managers act as the priests of old, adopting a precedent as a sacred flame which has passed from hand to hand, from generation to generation, each keeping it inviolate, never changing it, until it becomes a sacred tradition before which youth, and skill and brains and power must bow in submission. The rule-of-thumb manager is always a liability and never an asset. He may be popular, he may have succeeded, he may be succeeding, but just as inevitably as the sun rises, his day is done.

GOVERNMENT TELEPHONES.

A report of Postmaster General Burleson on "Government Ownership of Electrical Means of Communication" has been going the rounds of the press, and inasmuch as it bears the "Pure Statistic" stamp of the government it is accepted as an accurate presentation of the thing it relates to. Among other things it contains is a table giving comparative long-distance telephone charges in various countries for one thousand miles. This table claims the following figures as official:

Telephone Charge for 1000 Mile Message.	
Norway	$0.40
Germany	.48
Sweden	.54
France	.58
Japan	1.37
United States	6.00

These figures were exceedingly interesting to readers until a disagreeable chap on the Minneapolis Tribune did a little measuring in those countries where these thousand mile rates prevail, and he found:

First: That a telephone line a thousand miles long in Norway and Sweden would reach beyond the region inhabited by users of the telephone.

Second: That the longest straight line in Germany is about eight hundred and fifty miles.

Third: That the longest straight line in France is less than eight hundred miles.

Fourth: That the longest straight line in Japan is about five hundred miles.

And finally: That between these countries there are no international rates!

All of which suggests first the possibility that we have a government-controlled statistic factory concealed somewhere down at Washington and second, that after all that was a wise remark of good old Josh Billings when he observed: "It's better to know nothin' at all than so much that ain't so!"—John Kendrick Bangs in Concerning Municipal Ownership.

Increase in population of Pacific Coast states is shown by statistics of the Census Bureau to have been considerably greater during the past decade than in any other part of the United States.

USE OF THE DIESEL ENGINE IN THE NAVY.

BY C. H. WOODWARD, LT. COM., U. S. N.

(The following is from an address given by Lt. Com. Woodward upon the occasion of the commencement ceremonies of the installation of the initial exhibit in the Machinery Palace, Panama-Pacific International Exposition.—The Editors.)

The most important question in shipbuilding to-day, as it was a century ago, when steam power was first utilized, is that of propulsion.

Many wonderful inventions along this line have been made in the meanwhile, of course, but the greatest improvements have been recorded during the past fifteen or twenty years. Most notable among these are the water-tube boiler, the turbine, superheated steam and last, but not least, the Diesel engine.

The Diesel engine has a big future before it.

As many difficulties were encountered with the marine steam engine and the turbine, at the outset, however, so are there many unsolved problems with the Diesel engine to-day. Even though it has made wonderful strides in the past decade, it is still in its infancy so far as marine installation is concerned, and much preliminary experimental work remains to be done before it reaches that degree of development of the steam engine. Its early adoption for propelling large vessels is unlikely, but its ultimate adoption is almost certain.

It must be borne in mind that the advent of the turbine and economics resulting from use of superheated steam, together with other recent improvements in efficiency of the steam engine, have rendered the task of advocates of the internal-combustion engine more difficult. Moreover, the replacement of the turbine steam engine by the oil-engine involves a return to the reciprocating type of machinery which is, in itself, a ground of objection as being in a sense a retrograde step, for at present there seems to be no prospect of the evolution of a successful turbine oil engine.

The stage of development that the Diesel engine has now reached, however, is such that it's bound to receive serious attention when the question of the means of propulsion is considered.

The principal disadvantages of the steam engine as a means of propulsion is the great loss of efficiency due to the complicated indirect development of power by generating steam in a boiler, while the oil motor short circuits this intermediate member, and develops the power directly at the point where it is required—namely at the engine itself, thereby increasing the overall efficiency from about 7 to 12 per cent in the case of the steam engine to about 22 to 35 per cent in the case of the Diesel engine.

In other words, the cost per h.p. developed by the Diesel engine is between one-third and one-quarter that developed by the steam engine. Thus it will be seen, that the abolition of the boiler which constitutes a constant source of care and danger and requires a large, well-trained staff for operation, not only increases the efficiency of the plant, but also reduces considerably the weight and space occupied by eliminating coal bunkers, stacks, boiler room and boiler room auxiliaries, which can be converted into storage space for cargo, and reserve fuel may be stored in double bottoms and parts of the ship that were formerly waste.

The oil engine has a marked superiority over the steam engine in many ways, for in addition to its economy in regard to space, fuel and attendance, the ship's radius of action is about doubled, labor is reduced, fueling is facilitated, and stand-by expense is eliminated, as the engine can be started cold, at a moment's notice.

Unfortunately, however, there are many difficulties attached to the construction of marine Diesel engines with large cylinders at the present time, but so much attention is being given to the subject by eminent engineers that it is confidently expected that these difficulties will be overcome.

Diesel motors have proved both capable of standing long runs as well as capable of further development in power. However, comparatively few vessels of over one thousand h.p. have been in service long enough, as yet, from which to get proper data, consequently we are not sufficiently advanced to install very large units. Meanwhile the use of Diesel engines of moderately high power on shore is making steady progress, and much has already been accomplished in its application to marine work.

Many of our latest submarines are equipped with this engine, and contracts have been closed by the government for their installation in others that are now building, and while the Diesel engine is an ideal source of power for a submarine, we do not look on the present designs as final. We expect great improvements, and both the builders and government officials are constantly studying the situation with this end in view.

Due to its increasing reliability the Diesel engine has been adopted in place of the cruising turbine in several of the recent destroyers (Firedrake class) built by the Messrs. Yarrow for the British Navy, because its consumption of fuel is considerably less. Diesel engines for use at cruising speeds maintain a high enonomy and it is estimated that this installation will increase the radius of these destroyers, at economical speed, from 3000 to 8000 miles. Of course, these destroyers are also equipped with boilers and high power turbines to be used for full speed, as the propulsion of destroyers at full speed by Diesel engines is not practicable.

Diesel engines may also be used for auxiliary purposes in large ships, enabling them particularly to use electric light and power in port with minimum attendance and considerable economy due to their independence of boilers.

Our own navy is building, right here at Mare Island, two large colliers—the Kanawha, which will be equipped with reciprocating engines, and the Maumee, equipped with Diesel engines. This is being done in order to find out in a practical way the comparative economy between the two types. Both vessels are identical in size and power, having the following characteristics:

Characteristics of Colliers Now Building.

Length	475 ft.	Displacement	14,500 tons
Beam	56 ft.	Horsepower	5,000 h.p.
Draught	26 ft. 4 in.	Speed	14 knots

The Kanawha, which is at present on the ways, will be launched in about one month and immediately after the Maumee's keel will be laid on the same ways. The Maumee's engines are to be of the twin screw, Disel two-cycle type. Each engine will have six cylinders, 24 in. dia., and three scavenging cylinders. It will require 120 r.p.m. to obtain the 14-knot speed. This will be the first large sea-going American vessel fitted with Diesel engines.

Results from the tests of these two ships will be carefully studied, and will have a great deal to do with our future policy in equipping large colliers and other vessels.

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REMOVAL NOTICE.

In order to care for increase of business and to facilitate publication, the offices of the Journal of Electricity, Power and Gas have been removed from the Rialto Building to more commodious quarters in the new Crossley Building, corner New Montgomery and Mission streets, San Francisco.

Capitalizing Hope

There is being gradually fastened upon public utilities a code of conduct of their business which differs widely from that formerly accepted. Utilities are apparently a thing apart; the disadvantages under which they are required to operate being forced upon them under the specious plea that actually, because they have so great a number of customers—have developed so magnificent a service—they are thereby required to share with the public they serve part of the reward which their speculative enterprise and skill has produced.

The circumstance of determining the capitalization of utilities for rate-making purposes, for example, leaves but the bare bones of the business upon which to build the small percentage of profits permitted.

In this operation depreciation is determined and deducted, but appreciation, built into the business while this has occurred, may be disallowed. This is not definitely decided.

A finding of the Master in Chancery in the suit brought by the Pacific Gas & Electric Company against the City and County of San Francisco to prevent the ordered gas rate from going into effect and which went adversely for the company, disallowed in reducing the stated amount of the company's capitalization the item of "good will."

Fifteen per cent was deducted by the Master for "depreciation," which item, though less in proportion than the amount claimed by the company for "good will," is of greater magnitude in that deductions for depreciation are constant, while good will, once capitalized, is comparatively slow of growth.

On the other hand, a unanimous decision recently handed down by the New York Court of Appeals on the Kings County Lighting Company rate case recognizes and defines this item of "good will" or "going value," which is therein stated, for rate-making purposes, to be:

> The amount equal to the deficiency of net earnings below a fair rate of return on the actual investment due solely to the time and expenditures reasonably necessary and proper to the development of the business and property to its present stage, and not comprised in the physical valuation of the property.

While this decision and definition is not all that might be wished for, yet it is a step in the direction desired, namely, recognition of the intangible though valuable asset of community friendliness, or good will.

In the public utility business the conservation of efficiency necessitates the cultivation of good will, for it reduces selling costs, otherwise necessary, and the excessive legal cost of engaging in that business.

It is permissible in the interests of improved service to scrap equipment not outworn, but made obsolete by invention. These improvements are capitalized, and it should similarly be possible for public utilities to capitalize efficiency of whatever kind.

Whether under monopolistic conditions or in competitive areas, the great signification of good will lies in the fact that it constitutes a hope founded upon a probability of business perpetuity and expansion because of past satisfactory service.

Surely this invests the business with a value above the actual selling price of the material assets, and thus makes possible the capitalization of hope and a rate of return more commensurate with the effective utilization of investment.

There is a similarity between national organizations and the advertising medium with a large general circulation, which it will be profitable to consider. Value is the measure of desirability in each instance.

Sectionalized Effort

None will question that they have value, but the question does arise as to whether maximum value is secured from use of the one or membership in the other. This depends of course upon the particular use desired of either.

As a technical journal and technicians of specialized employments, consider their use for specific purposes.

The medium with a large general circulation has but little value for specific advertising—paid publicity of interest only to a known few—and much of an advertising appropriation—these rates being usually based upon circulation—is therefore wasted.

The manufacturer of turbo-generators, to make the argument instantial, could perhaps reach as many interested executives and engineers through the pages of a popular magazine as through a technical journal, but the latter's smaller, because specific, circulation, permits lower advertising rates, though not necessarily proportional to the circulation difference.

Moreover, there is a greater certainty of reaching those most interested through the technical journal and at a time when their minds are most receptive to the information given through the advertisement. In the periodical with the general circulation, and therefore written for readers in general, there are distracting counter presentations and the life is usually shorter than that of the technical journal which is kept on file at least temporarily, and often in permanent form.

Subscribers are solicited promiscuously where magnitude of circulation is the aim, but publishers of technical journals foster circulation only among those readers who add to the value of their journal as an advertising medium.

Fundamentals are the same the world over, but practical problems vary with geographic location.

Over a territory as extensive as these United States are conditions varying between wide extremes.

National associations dealing with the practical side of the public utility business, for example, may be likened to those periodicals which have a large circulation representative of diversified interests. The utmost endeavor put forth does not cover the situation completely over every section, and recourse must be had to the geographic section which is now found to be most important and which may be likened to the technical journal with a specified purpose and specific circulation.

Effectiveness is secured only by specialization, which in turn necessitates localization or concentration of effort.

The national organization should deal only with those problems of interest to the entire industry, leaving to geopraphic sections the special problems of local importance.

The Northwest Electric Light and Power Association may be indicated as illustrating this principle, but there is also the necessity for a Southwestern Pacific Light and Power Association of a similar nature.

These associations, for the greatest effectiveness, should be branches of a Utilities Association of the Pacific Coast, thus permitting maximum authoritativeness, strength and expedition to any action of importance.

Such an association is advocated and such sectionalization of effort will always receive the support of this journal.

Scientific management is the opportunity and haven of labor, the economizer of capital and the harmonizer of both. Better pay for more congenial work is the goal of labor and the most for its money the aim of capital. Scientific management supplies both these wants, and more.

Scientific Management

If you would adopt scientific management and enjoy its progressive rewards, you must, as an employer, be prepared to pay high wages. This is at once the penalty and privilege of this practice; the penalty only because of a gain which seems loss until understood, the privilege because effective utilization is then assured in all departments—administrative, financial, producing and selling.

If you are an employee, you should realize that scientific management will require of you a greater output, but it will do this with a considerateness which will improve working conditions and shorten the hours of labor by increasing your effectiveness.

And because scientific management conserves, it makes possible the payment of more just wages.

And what is scientific management?

It is "a conservation which conserves." It does not depend upon complete but upon effective utilization; not upon how much you can get out of a workman, to state a case to point, but for how much of his best effort consistent with continued production is the employer so able to plan his work that he may be suitably rewarded.

To many it will prove astounding that scientific management calls for periods of rest; for instruction of employees; counsel; considerateness and the consequent seemingly superfluous expenditures.

But this is true, and it is in the need for these expenditures that the further value of scientific management is found for the electric, power and gas industries.

A study of scientific management opens new channels for the outpouring of your goods, as will educative effort always.

For in business no man can know of the better way and not tell another. Not to do this is to destroy the mainspring of present-day business, which is service.

You may show to the man of busy-ness unable to read these necessary signs as he runs the strenuous gauntlet of a management which does not manage. the gain of good lighting or improved machinery, the desirable effect upon his employees of more constantly renewed air and so forth.

These are a few of the reasons why the articles on Management, commencing in this issue, are included. They are of importance to you.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

Chas. W. Baker, district engineer Westinghouse Machine Company, is in Southern California.

W. R. Studenmund, Pacific Coast representative Gillinder & Sons, Inc., is at Vancouver, B. C.

J. I. Colwell, sales manager Seattle office Western Electric Company has returned to that city from a southern trip.

W. J. Taylor, of Pease, Bundy & Taylor, engineers and electrical contractors, Porterville, Cal., was a San Francisco visitor during the past week.

Ryotaro Mitsuda, electrical engineer to the Imperial department of communications, Tokyo, Japan, is a visitor at San Francisco.

H. C. Goldrick, manager Pacific Coast office Kellogg Switchboard & Supply Company, has returned to San Francisco from the Pacific Northwest.

Chas. B. Babcock, manager Pacific Coast office of the General Gas Light Company, San Francisco, has been elected a member of the Illuminating Engineering Society.

O. W. Lillard, Pacific Coast manager of the Gould Storage Battery Company has left San Francisco on a business trip to Salt Lake City and Denver and will return via the Pacific Northwest.

J. W. Bryant, who for some time past has been identified with the sale of Wagner apparatus in that territory, will have charge of the new office of the Wagner Electric Company at Syracuse, N. Y.

Chas. A. Walker, president of the White Pine Telephone Company, recently interested himself in the formation of a company to construct an interurban telephone line from Ely, Nevada, to Preston and Lund.

L. E. Sperry, manufacturers' representative, San Francisco, is now agent for American Circular Loom, vice **John R. Cole,** who has resigned to engage in the real estate and insurance business at San Francisco.

William Scott, superintendent of lines and electric service, Utah Light & Railway Company, was elected Grand Master of the Odd Fellows Lodge for the state of Utah at the last Grand Chapter held in Logan.

R. H. Sperling, until recently general manager and now a director of the British Columbia Electric Railway Company, Ltd., is at Vancouver, B. C., from London, England, and expects to remain in the West until the later part of July.

L. E. Hanchett, formerly interested in San Jose and Santa Clara electric railways, has been elected to the directorate of the Northern Electric Railroad and will be made chairman of the executive committee of the company.

H. B. Pierce, assistant commercial agent of the Washington Water Power Company, Spokane, Washington, spent a couple of days in Salt Lake City last week looking over the local situation. Mr. Pierce is on his way to the Philadelphia Convention of the N. E. L. A.

Charles L. Eshleman has resigned as general sales manager Adams-Bagnall Electric Company, Cleveland, Ohio, to become vice-president and general sales manager of the Union Metal Manufacturing Company, Canton, Ohio, which company is making arrangements to build a new factory, doubling its capacity.

Thurston Owens, one of the incorporators of the San Diego Gas & Electric Appliance Company, has been identified with the public utility business for the past 12 years, having been assistant superintendent Consolidated Gas Company of New York city, assistant engineer city of New York, associate editor American Gas Light Journal, and general manager La Crosse (Wis.) Gas & Electric Company. The Appliance Company bought out the San Diego Gas Appliance Company, took over the stock of the local gas and electric company, and are handling the lines of the General Electric Company and the Pacific States Electric Company in San Diego county.

H. F. Yost, secretary and treasurer of the Electric Stores Company, Inc., Sacramento, Cal., and Reno, Nev., was at San Francisco during the past week. Mr. Yost was previously with the Electric Appliance Company. **F. V. McAvoy,** who is president and general manager of this new company, was formerly the proprietor of the Reno Electric Works, which has been absorbed by the new company.

H. W. Burkhart, formerly with the Southern California Edison Company, was at San Francisco during the past week and among other matters attended to business in connection with his part of the Pacific Coast Gas Association Convention program. Mr. Burkhart announces that he has removed his offices to the International Bank Building, Los Angeles, where he will continue his consulting engineering practice in matters relaing to gas properties.

Tracy E. Bibbins, local manager San Francisco office General Electric Company, is in attendance at the National Electric Light Association Convention at Philadephia. Representing the Pacific Gas and Electric Company are **S. J. Lisberger,** engineer electrical distribution, and **F. H. Varney,** chief steam engineer, both of San Francisco. **John A. Britton,** vice-president and general manager of the Pacific Gas and Electric Company, and first vice-president of the N. E. L. A., was unable to attend on account of matters of importance in connection with the administration of his company. It is hoped that the San Francisco contingent, though small in numbers, will use sufficiently forcible arguments to bring the convention to San Francisco in 1915.

Jas. R. Petrie, manager of the electric light plant at Mazatlan, State of Sonola, Mexico, who is now at San Francisco, is able to tell a war story which at long-distance takes on a humorous turn. At Mazatlan the Federals (not those of the baseball war) had encircled the city with barbed wire, which the electric company was required to keep charged at high pressure. This proved in some way a barrier to the rebels, who tried, though for some time unsuccessfully, to get into touch with Mr. Petrie in order to convey to him the intelligence that he would be shot if the wires were not rendered harmless, by shutting down the plant. This information got to the Federal commander first, who indicated that if the plant were shut down the manager would be shot as a rebel. Mr. Petrie learned of his lodgment on these horns of a dilemma when the rebel leader ultimately got the message to him by means of a letter attached to a chicken (with feathers) which was dropped from an aeroplane. This, it is said, is the perfectly (h)armless "bomb" dropped in Mazatlan which was reported to have killed certain Americans and Britishers. Then Mr. Petrie found that Mexican patriotism consisted in stoning American citizens because of the taking of Vera Cruz and realizing that that either to run or not to run the plant resulted in shooting and the killing of a mortal coil which he would much prefer to remain charged, Mr. Petrie decided that to run himself and not the plant was the better part of valor. Having gathered a few valuables, this he did. Mr. Petrie has not decided just what he will do, but just as he finished this story a phonograph in the store across the way was heard singing, "And when he'll go back again nobody knows," or words to that effect.

MEETING NOTICES.

Seattle Engineers' Club.

The regular meeting was held after luncheon at the College Club on May 14th, when Glenville A. Collins gave an interesting talk on "Efficiency—Its Cause and Effect."

California Association of Electrical Contractors.

San Francisco Local No. 1 attended the Commonwealth Club as a body and heard the address by Will S. French of the Industrial Accident Board on "Safety First."

San Francisco Electrical Development and Jovian League.

The meeting held at the Hof Brau last Tuesday furnished an excellent paper in that delivered by T. E. Collins of the Westinghouse Electric & Manufacturing Company, on "Modern Merchandising and the Electrical Contractor," which was appreciated by all present. C. C. Hillis was chairman.

Oregon Electrical Contractors' Association.

The place of meeting for the second annual convention, June 8th and 9th has been changed to the Pittock Block, which offers more suitable facilities. There is no change in the program previously reported. The banquet and entertainment will be held at the Portland Hotel at 8:30 p. m. on June ninth.

Portland Electrical Contractors' Association.

At the last regular meeting of the Portland Electrical Contractors' Association the following officers were elected for the ensuing year: Robert. Skeen, president; J. H. Sroufe, vice-president; J. R. Tomlinson, treasurer; W. O. Fouchs, W. H. Smith, H. H. Fitzpatrick, B. J. Boicourt, and L. A. Walker, executive committee; and F. C. Green, secretary.

Seattle Bell Telephone Society.

The regular monthly meeting of the Bell Telephone Society was held at 8 p. m., Thursday, May 21st, in Eiler's Hall, third floor of the Eiler Building, Third avenue and University street, Seattle. The technical feature consisted of an interesting talk by District Traffic Chief J. W. Newell, whose subject was "Traffic." The entertainment committee furnished a good program.

Alameda County Electrical Development League.

The league met at a downtown Oakland cafe on May 23d, and enjoyed two papers, one by T. E. Collins of the Westinghouse Electric & Manufacturing Company, on "Modern Merchandizing by Electrical Contractors," and the other by M. H. Gregg of the Joint Pole Committee on "Present Problems of Distribution." This journal as the official organ of the league, was requested to publish these papers and they will appear at an early date. Wiring bids will be opened at the June meeting.

Los Angeles Section A. I. E. E.

The regular meeting was held on the evening of May 26th, at the University of Southern California. The subject of the evening was "Some Features of Teaching Electrical Engineering." Demonstrations of use of models and adjustable diagrams to illustrate certain principles of operation of electrical machinery were given by D. B. Munroe and E. L. Arnold, and a brief outline of courses and methods in use at U. S. C. will be given by A. W. Nye. Members present gave their views on what subjects may be taught to electrical engineering students with greatest profit.

Utah Light & Railway Company Section, N. E. L. A.

The regular monthly meeting of the Utah Light & Railway Company section of the N. E. L. A. was held at the company's new commercial office and electric shop at 154 Main street. Lloyd Garrison, in charge of the electric shop, gave a talk and demonstration of the various electrical appliances on exhibition there. At the conclusion of this demonstration an electrically cooked luncheon was served to the members under the direction of Mrs. Olive Huppert, the company's demonstrator. The meeting then adjourned to the Consolidated Music Hall where the regular meetings are held, and details for the section's summer outing at Pine Crest at the head of Emigration Canyon scheduled for June 13th were discussed.

Utah Electric Club.

The regular weekly luncheon of the Utah Electric Club was held at the Commercial Club Thursday, May 21st. The speaker of the day was Byron Cummings, Dean of the University of Utah, who told of the extensive explorations in southeastern Utah, principally in San Juan county, made under his direction by the University. The natural bridges to be found in this locality far exceed in magnitude and beauty those existing at any other known locality in the world, the largest having a span of 345 ft., and an arch 241 ft. in height. The University exploration parties were able to find in some of these remote and almost inaccessible canyons the remains of large villages of cliff dwellers which had not been previously visited by white men. They were thus able to secure some of the most interesting relics of the cliff dwellers available in this country.

Utah Eleciric Club Outing.

The first summer outing of the Utah Electric Club was held at Lehi, Saturday, May 16th, the trip of thirty miles being made over the new Orem interurban electric line. A special train, in two sections, left at 1:30 in the afternoon and two hundred and fifty members of the club participated in the enjoyable outing, elaborate preparations for which had been made by the entertainment committee. The local electrical jobbers, retailers, contractors and central station companies closed their establishments at noon so that their employes could take part. A closely contested game of baseball between a picked team of the Electric Club and the Lehi team of the Utah County League, which won the championship last year, was won by the Lehi team—score six to five. After the game a picnic banquet was served to the members by the ladies of the Lehi Commercial Club, and in the evening a ball was enjoyed by the excursionists in Lehi's new dancing pavilion. The entertainment committee, which had charge of the affair, consisted of L. E. Brown, chairman; J. V. Buckle, Bruce S. Cramer, J. G. Guiver and Julius F. Derge.

San Diego High Potential Blow Out.

The electrical interests of San Diego had a real old fashioned blow out Saturday, May 23d, at the well known amusement park, "Wonderland," at Ocean Beach near the city. After a number of successful weekly luncheons it was decided to hold an outing and the committee made it a "blow-out."

Promptly at 12:30 p. m. the parade of some 25 autos left the plaza with the members and their friends and then whizzed to the beach where a buffet luncheon was served. From that moment until the lights were out everyone was on the jump or the hop-skip-and-jump, or in the tug-of-war or the 50 yd. dash or the cracker eating contest or the ball game, etc., ad lib.

There were almost as many prizes as there were contestants and there were many more contests than those named. The most important event was the shot put, which was won by Mr. Hartwell, the dean of the electrical industry in the city, but it was discovered that the shot he used was made of Aluminum instead of iron.

Promptly at 6 dinner was served to the 175 who were present at the Casino and then more talent was discovered as those called upon proved to be real entertainers instead of after-dinner speakers.

The success of the affair was mainly due to the efforts of Chairman Howell and Messrs. Nightingale, Crist, Holloway and Mayer.

The sentiment of those present was well expressed in the chorus of a song written for the occasion by Mr, Nightingale:

High Potential Men—We are on a blow-out
Fuse it up again—It will make you shout,
Here we are together—Good time for all,
And we'll have another blow-out some time next fall.

Picnic of General Electric and Pacific States Electric Companies.

Contrary to the weather prognostications of Hop Sing and Wilson Saturday, May 23d, was rainless at Idlewood Park, Niles Canyon, which was the scene of the second annual picnic of the San Francisco offices of the General Electric Company and the Pacific States Electric Company. Here a crowd of nearly five hundred employes and their families spent a happy day, not even an office boy being left to answer the telephone in the city offices.

A special Western Pacific train took the crowd and a brass band to the scene of the festivities. After the lunches had been cached the first business of the day was a tug-of-war between the strong men of the two companies, the General Electric winning the match. Then in quick succession followed various races and athletic contests. The boys competed in a hundred yard dash, hop-skip-and-jump, a three-legged race and a pie-eating contest. The ladies tried their skill at baseball throwing, a potato race, knife and bean contest and wood-sawing. Handsome prizes were awarded the winners and much amusement afforded the spectators.

Dancing was the order of the afternoon, interrupted only by the trial of one W. L. Goodwin, who was adjudged guilty of attending certain games of baseball during office hours. The jury consisted largely of ladies, which fact, together with his attempted break for liberty, is largely responsible for the verdict.

Finally at five o'clock the train was ready to take the joyous crowd home. All present voted the occasion most pleasurable and conducive to a friendly spirit of co-operation, thus making future picnics of the same kind quite probable.

The various valuable prizes were won by the following:

Gate Prizes—A. G. Jones (G. E.), suit case; H. Cooper (G. E.), camera.

Hand Ball Throwing—Mrs. T. E. Bibbins (G. E.), three pair silk stockings.

Knife and Bean Race—Miss U. Bibbins (G. E.), hand bag.

Wood Sawing Contest—Mrs. Lewis (G. E. guest), corsage bouquet.

Potato Race—Miss V. Peirce (P. S. E.), hand painted powder jar.

Tug-of-War—General Electric Company, cup.

100 Yard Dash—Percy Goodwin (P. S. E. Co.), watch fob.

Hop-Skip-and-Jump—H. E. Peets (G. E.), fountain pen.

Three-Legged Race—F. Mulvany and L. Van Atta (P. S. E.), two tie clasps.

Pie Eating Contest—Charles Goodwin (P. S. E.), baseball shoes.

Childrens' Games (hand ball throwing, under 12 years)—Carl Corcoran, skates; under 7 years. Frank McNeales, push

The Jovian Electrical League of Southern California.

The weekly luncheon at Christopher's on May 20th was attended by about 100 Jovians and was presided over by James Irvine. A splendid musical offering was rendered by the Kraum Trio from the Victoria theater, New York. An interesting lecture, illustrated by many beautiful and instructive lantern slides, was delivered by Prof. Cyrus A. Clark, a missionary who has been living and working in Japan for the past 27 years. He not only described the home life and customs of the Japanese, but portrayed by means of slides the various operations incident to the rice, tea and silk industries. The following letter and resolution, which is self explanatory, was unanimously adopted:

City Council, Los Angeles, Cal.:

Our league, which is composed of a majority of the electrical engineers, contractors, dealers, central stations, manufacturers and wholesalers of Southern California, has watched with great interest the progress and lack of progress in the fire alarm situation in this city. From time to time efforts have been made to afford the city much needed relief from the dangerous conditions in whch we are placed owing to the inadequate system with which our fire department is now hampered. We understand that specifications were prepared and approved by a former city council, so that the best system might be selected, looking towards open competitive bidding and demonstration of all apparatus.

At a meeting of the league today, the enclosed resolution was duly passed and the secretary instructed to send this communication, together with a copy of the resolution to your honorable body, in the hope that, by proffering our services, free of expense, we might, as citizens, demonstrate our keen desire to help.

If our efforts can be used to advantage we would gladly appoint a committee to act in the city's behalf as suggested in the resolution.

JOVIAN ELECTRICAL LEAGUE OF SOUTHERN CALIFORNIA.
(Signed) K. E. Van Kuran, Secretary.

Copy of resolution adopted by the Jovian Electrical League of Southern California at its meeting held in the city of Los Angeles, May 13, 1914:

Whereas, The Jovian Electrical League of Southern California has taken a lively interest in the action and discussions of the council relative to the construction of a fire alarm system in our city, which is stated as probably involving an expenditure of a quarter of a million dollars, and

Whereas, It is the opinion of this league, that the only safe method for the city to enter upon such a great outlay as that contemplated, is to secure competitive bidding from all manufacturers with complete demonstration of apparatus and instruments, and

Whereas, Specifications have already been approved by the city council looking towards open competitive bidding that will not favor any particular manufacturer.

Now, Therefore, Be It Resolved, That this league proffer its services without expense to the city in examining the aforementioned specifications, to approve or disapprove said specifications, and if disapproved, to furnish the city with complete specifications which will be ideal in that all manufacturers of fire alarm apparatus or instruments can bid competitively, and

Further, Be It Resolved, That said specifications will not favor any manufacturer of instruments or apparatus or any particular type of construction or material, but will be based solely on results and service, requiring open demonstration.

J. N. COLLKITT, Chairman.

Attested by K. E. VAN KURAN, Secretary.

The rejuvenation prize winners were announced by Chairman Collkitt and many guests were introduced.

INTERNATIONAL ENGINEERING CONGRESS, 1915.

Among the general subjects to be treated before the International Engineering Congress, 1915, probably the one having the broadest interest is that of Materials of Engineering Construction, which enters into all phases of engineering activity.

The list of topics which will be treated in this section is as follows:

(1) Timber.
(2) Preservative Treatment of Timber.
(3) Substitutes for Timber in Engineering Construction.
(4) Brick in Engineering Structures.
(5) Clay Products in Engineering Structures.
(6) Probable and Presumptive Life of Concrete Structures made from Modern Cements.
(7) Aggregates for Concrete.
(8) Slag Cement.
(9) Waterproof Concrete.
(10) Cements containing Additions of Finely Ground Foreign Material.
(11) Economics of the World's Supply of Iron.
(12) The Life of Iron and Steel Structures.
(13) The Employment of Special Steel in Engineering Construction.
(14) The Place of Copper in the Present Engineering Field, and the Economics of the World's Supply Thereof.
(15) Alloys and Their Use in Engineering Construction.
(16) Aluminum in Engineering Construction.
(17) The Influence of the Testing of Materials upon Advances in the Designing of Engineering Structures and Machines.
(18) Cement Testing.
(19) Testing of Metals.
(20) Testing Full-Sized Members.
(21) Proof Testing of Structures.

The papers to be presented from the United States have already been arranged for from the recognized leading authorities on the various topics. Arrangements for the papers from foreign authors are being rapidly concluded, and the aggregation of papers which will be presented will constitute a broad review of the field and be of the highest value.

Marked interest in the congress from foreign countries continues, and there is every evidence that the attendance from abroad will be large. It is hoped that all engineers in this country who have not yet subscribed as members of the congress will give the matter their immediate attention and favorable action.

Full information concerning the congress, the price of subscription, and the arrangement for purchase of volumes of the proceedings, may be obtained by addressing the Committee of Management, Foxcroft Building, San Francisco.

ERRATA.

Busch-Sulzer Bros.-Diesel Engine Company has directed our attention to an error in our report on p. 448 of the last issue made in connection with the installation of their Diesel engine exhibit at the P. P. I. E., in which it is stated that the Diesel Engine Company is the only manufacturer of these engines in the United States. This should have read the oldest established manufacturer or the only manufacturer in the United States building Diesel engines exclusively.

The information given in our last issue under "Transmission," p. 462 regarding the new transbay submarine cable of the Great Western Power Company is incorrect as the contract is being carried out by A. J. Pahl, K. P. F. Electric Company, San Francisco, as stated in our issue of April 18, 1914. The old cable is to remain in service.

TRADE NOTES.

Central Electric Company has removed to the new Crossley Building, San Francisco, from their former location on Stevenson street.

Fairbanks-Morse were low bidders on a contract for furnishing the city of Seattle with a pump and electric motor for the sum of $1650.

The Technical Book Shop will now be found at the new Crossley Building, corner New Montgomery and Mission streets, San Francisco.

The Wagner Electric Manufacturing Company, St. Louis, announces the opening of a sales office at 524 University Block, Syracuse, New York.

The offices of the Technical Publishing Company have been removed from the Rialto Building to the new Crossley Building, corner New Montgomery and Mission streets, San Francisco.

The Crocker-Wheeler Company, electrical engineers and manufacturers, are removing from the First National Bank Building, to the new Crossley Building, corner New Montgomery and Mission streets, San Francisco.

The Allis-Chalmers Manufacturing Company has secured an order for the complete equipment of an electrically driven redwood sawmill, from the E. B. Salsig Lumber Company, of Gualala, Mendocino County, Cal. The order includes an 800 kw. turbine, motors aggregating 1600 h.p. and the necessary sawmill machinery.

The Kellogg Switchboard & Supply Company has closed a contract with the Farmers Mutual Telephone Company for a complete telephone exchange system for Blaine, Washington. The installation will include the latest type of common battery development with eight party harmonic selective ringing apparatus. When completed, the plant will be the most modern in the state of Washington.

Removing iron particles from ground scrap rubber in the reclamation plant of a rubber mill and extracting the metallic iron from crushed slag in the steel plant are two new applications of Cutler-Hammer magnetic separators that have recently been made. The separating is effected on a belt over the magnetized pulley which picks out the metallic particles and allows the balance to be cast forward to a conveyor or chute.

J. D. Ross, superintendent of the city lighting department, Seattle, Wash., announces the arrival of the principal machinery for the new auxiliary steam plant now under construction. The machinery, being furnished by Chas C. Moore & Company, Engineers, and now in the yards of the Milwaukee railroad, consists of 3000 h.p. Stirling water tube boilers, making eight carloads, also four carloads of condensing apparatus made by the Wheeler Condenser & Engineering Company, and heaters and pumps from the Platt Iron Works.

LIST OF APPROVED FITTINGS REVISED.

Advance copies of April, 1914, List of Approved Electrical Fittings are to hand and attention is directed to the following: Two new subject headings have been added, reading "Soldering Flux" and "Lightning Rods." Explanatory notes have been inserted under sockets and receptacles. A receptacle is defined as a lamp holding device designed to be attached to a flat surface or within a box by means of screws or by a clamping ring. A socket is a lamp holding device designed to be fastened to a threaded pipe (as on fixtures) or on supply wires, as a pendant. Sockets and receptacles are in general grouped under Key, Keyless and Pull. A distinction has been made between auto starters which disconnect all lines when in the off position and those which do not. Aside from the above the only changes consist in the usual additions, omissions and corrections necessary to bring the list up to date since the last issue.

CALIFORNIA ASSOCIATION OF ELECTRICAL INSPECTORS

Section of N. A. E. I.

C. W. Mitchell, President. Arthur Kempston.
Wm. G. Pennycook, Vice-Pres. B. C. Hill, Executive Comm.
John W. Carrell Secretary-Treasurer, 55 Fulton, San Francisco

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correllate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

By the Secretary.

WIRING AND EQUIPMENT OF METER LOCATIONS.

[Concluded.]

The best known methods of equipping meter locations are: the accessible wire-way system, Fig. 1 (fully described in the issue of May 23, 1914); to place all the wiring, switches and cutouts in a metal cabinet and to arrange

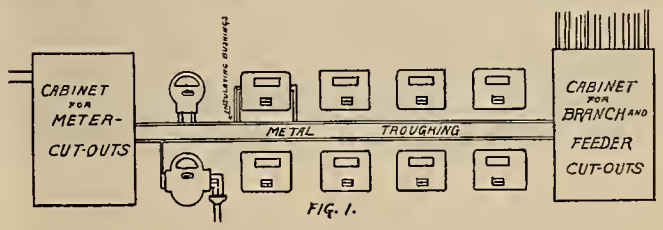


FIG. 1.

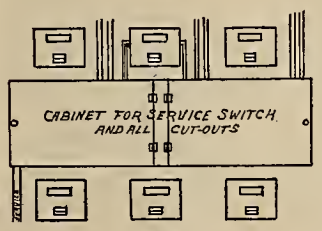


FIG. 2.

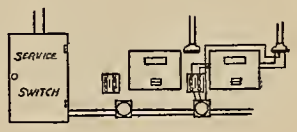


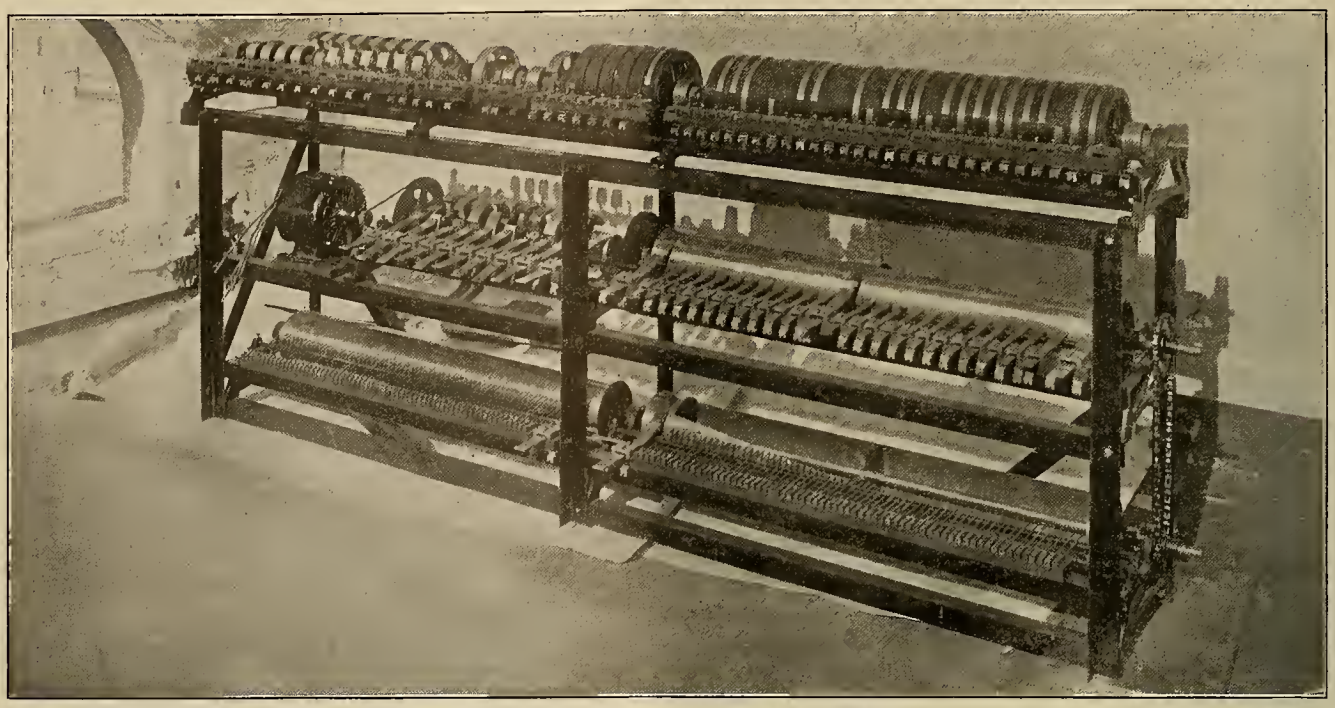
FIG. 3.

the meter loops as shown in Fig. 2; to run a feeder circuit along the meter board and to tap a loop and mount a cutout at each meter, in conduit as shown in Fig. 3, or to run the wires under the rules for open work; to place all equipment, including meters, in an approved cabinet, or to mount the meters on a switchboard of slate or marble.

Where the meters are grouped in a place at or near one of the principal entrances of the building or in a place which is easily accessible from the street, the ideal location for the main service switch is presented. It may be well to digress enough to point out that the measuring of the term "readily accessible" when applied to the service cutout is somewhat different than when applied to the main switch; the purpose of the first being to have as little unprotected wire within the building as practicable and that of the second being to cut off the entire current at a place which can be quickly and easily reached.

One of the principal difficulties met with in meter wiring presents itself when wires of different systems are brought into the same meter-locations, principally a.c. and d.c. services. Architects and engineers could modify this trouble by specifying that, "Each feeder circuit which leaves the meter location must be in a separate metallic armor, nor shall one metallic armor contain branch circuits which exclusively supply separate apartments or other sections of a building which are so arranged that the supply may be measured by a separate meter."

INDUSTRIAL



General View of "Ben Hur" Sign Flasher.

A LOS ANGELES ELECTRIC SIGN FLASHER.

One of the electric sky sign features at Los Angeles is that advertising Ben Hur Coffee, and located on the O. T. Johnson Building, corner Fourth and Broadway. The flasher, which is illustrated herewith, is 7 ft. long by 4 ft. high, and consists of 208 contacts, making and breaking over 2500 times per min., and carrying over 750 amp. The sign operated by this flasher consists of a face 12 ft. high of Mr. Coff. E. Bean, who is holding a cup over his head, the steam rising from the cup forming the words "Coff. E. Bean says." The wording "Ben Hur, Steel Cut, Coffee" is flashed on in three divisions, followed by the word "Satisfies," which writes out in script and finishes with a big flourish underneath, ending at a big coffee pot which is then flashed on. During these operations the face is continually changing, having six facial expressions, and a further eight of the eyes. The sign goes dark for an instant, and then the wording "Ben Hur Steel Cut Coffee Satisfies" flashes on as a whole. Then all the lights go out, and this cycle of operation is repeated.

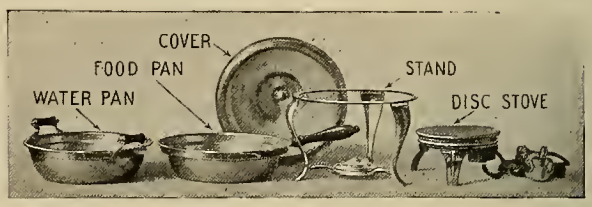
The flasher was designed and built by the Brown Flasher & Manufacturing Company, Los Angeles, Cal., and delivered by them to the Greenwood Advertising Company (Western) in twelve days from the time the order was received. The Brown Flasher Manufacturing Company handle all this class of business for the Greenwood concern, and all of their machines are built of material purchased in California.

DISC-STOVE CHAFING DISH SET.

A novel arrangement of a combination disc stove and chafing dish has been recently placed on the market. The set is similar to the ordinary alcohol type chafing dish except that it has an electric disc stove, in direct contact with the water pan, instead of an alcohol heater. The complete set consists of a stand, a disc stove, cord, three-heat switch, and attachment plug, a water pan, a food pan, and a cover, as illustrated.

All metal parts, except the top of the disc stove, are handsomely finished in polished nickel or polished copper. The handles are ebonized wood.

The heater of the disc stove consists of a steel disc inside of which the heating element is sealed and protected from oxidization. A dead-air space between the heater and the bottom of the stove casing acts as a heat insulator, preventing the loss of heat downwards, so that practically all of the heat is utilized, thus resulting in an efficient appliance.



Parts of the Type C Disc-Stove Chafing Dish Set.

With the feet of the disc stove reversed so that the stove can be suspended from the stand and with the parts assembled as shown the outfit is a chafing dish, capable of cooking anything in it that can be cooked in a chafing dish.



Chafing Dish Set Complete.

With the feet inserted in the stove the disc stove can be used separately, for any purpose that gas stove burners are used for, such as frying, grilling, making coffee, and similar operations.

The disc-stove chafing dish set is manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa.

NEWS NOTES

INCORPORATIONS.

CLIFTON, ARIZ.—The Morenci Water Company has filed articles of amendment of incorporation, increasing capital stock of the company from $500,000 to $600,000. M. H. McLean is vice-president and H S. Van Gorder, secretary.

BRIGHAM CITY, UTAH.—The Brigham Electric Company, a newly organized corporation with several Salt Lake electrical men as the principal holders of the stock have taken over the interests of the Flynn Electric Company. The officers of the new corporation are as follows: R. W. Nicol, president, Salt Lake City; Francis Pitt, vice-president and treasurer, Brigham City; W. D. Cummings, R. S. Folland, L. A. Herdtie, directors.

ILLUMINATION.

HUNTINGTON PARK, CAL.—The city trustees have purchased 96 cast iron posts from the Madson Iron Works, for $1487.50.

LEVENWORTH, WASH.—The Cashmere Electric & Water Company has applied for a franchise for furnishing power and light.

SAN MATEO, CAL.—The chamber of commerce has inaugurated proceedings for an electrolier system of lighting for the business district.

EL PASO, TEXAS.—Sealed bids will be received up to June 15th, for the construction of an addition to the electric lighting system at Fort Bliss, Texas.

GLENDALE, CAL.—An ordinance has been adopted authorizing the issuance of $4000 in bonds for the purpose of enlarging the municipal electric light and power plant.

WINSLOW, ARIZ.—An election will be held here June 5th, to vote on an ordinance to grant to C. M. Lang and H. P. Pattillo right to manufacture gas for heating and other purposes.

NORTH YAKIMA, WASH.—The directors of the Central Heating Company have applied to the city for a franchise for furnishing light and power in addition to heating, the cost of the proposed plant to be $100,000.

LOS ANGELES, CAL.—The city council has adopted an ordinance ordering the necessary appliances to be installed in Hollywood boulevard between Cahuenga and Wilcox avenues for lighting the street with electric lights.

SIERRA MADRE, CAL.—Plans for the proposed ornamental lighting system for Baldwin avenue have been presented to the city trustees by Engineer Bixby. They call for a single standard of copper covered steel or concrete surmounted by a single globe.

KAMLOOPS, B. C.—Tenders are called for the construction of a reinforced concrete power house to be built for the Barriere River hydroelectric development for the city of Kamloops. Messrs. Ducane, Dutcher & Company, Vancouver, are consulting engineers.

NAPA, CAL.—An ordinance has been passed by the board of supervisors granting to the Calistoga Electric Company a franchise to erect along certain streets in Napa county, wires, cables, etc., for the purpose of transmitting electricity for light, power and heat.

SALT LAKE CITY, UTAH.—The Utah State Capital Commission is advertising for bids for the electric lighting fixtures for the new state capitol. Bids must be received not later than June 5, 1914. Plans and specifications may be secured at the office of Richard Kletting, Architect, 415 Felt Building, Salt Lake City.

TRANSMISSION.

LANCASTER, CAL.—G. B. McLean, Pacific Light & Power Corporation representative, together with directors of the company, visited here recently investigating conditions relative to the proposed project of extending an electric power line into this territory.

MOUNT PLEASANT, UTAH.—The Big Spring Electric Company at Fountain Green have been experimenting with an electric pumping outfit on the place of Warren Holman in the southern part of the city. A flow of 480 gal. is easily obtained from a 33 ft. well using a 5 h.p motor. This flow is equivalent to about 2-3 of the regular irrigating stream. The cost of the well and pumping plant amounts to about $1200. The results secured have been so satisfactory that it is quite likely that several other plants will be installed in this vicinity.

BOISE, IDAHO.—Judge F. S. Deitrich has declared void the contract between the Idaho-Oregon Light & Power Company and Boise City, Idaho, under which the former was to furnish service for the new street lighting system at a rate of $11.24 per light per year. This contract was made under severe competitive conditions prior to the appointment of a receiver for the Idaho-Oregon Company. The receiver objected to complying with the conditions of the contract on the ground that to continue to furnish the service at his price would result in a loss to the creditors of the company.

SAN FRANCISCO, CAL.—N. W. Halsey & Company, fiscal agents of the San Joaquin Light & Power Company announce that a special meeting of stockholders will be held June 11 for the purpose of authorizing an amendment to the articles of incorporation by changing the $3,500,000 of unissued preferred stock into 6 per cent cumulative prior preferred stock, which will have preference over the existing preferred and common stock. The board of directors have also called a special meeting of the stockholders to be held on June 29 for the purpose of authorizing the issuance of $2,000,000 bonds or debentures, in case prior preferred stock either is not authorized or fails to find a ready market at a satisfactory price.

LAKEPORT, CAL.—The dredge which has been under construction by the Stockton Iron Works for the Yolo Water & Power Company here the past six weeks, was launched in Clear Lake a few days ago. The barge is 80 ft. in length, and the dredge will be a combined clamshell and suction type, also equipped with pile driver. The 150 h.p. gasoline engine, and other machinery, will be installed immediately. The Yolo company expects to start work on the Lakeport Lake front fill with the dredge. This is a project to dike and fill in the town's frontage on Clear Lake for a distance of 1800 ft., creating much new land, new streets and a park site. Two railroad companies have terminal sites in Lakeport. The Yolo company and individual property owners are co-operating in the fill.

SACRAMENTO, CAL.—A petition for a writ of review designed to test the constitutionality of the act under which the State Industrial Accident Commission was created, has been filed in the Supreme Court by the Great Western Power Company. The action is based on an appeal from the judgment of the commission in awarding damages to the widow of James W. Mayfield, who was killed at Sacramento in October, 1913, while cutting a live wire of the power company's lines without rubber gloves, which his foreman had ordered him to wear. The writ of review is asked for the purpose of having the Supreme Court determine the law-

fulness of an award made to Mayfield by the State Industrial Accident Commission, the lawfulness of the proceedings in which the said award was given and also the lawfulness of an order by the accident commission denying the power company a rehearing in the matter of the award

TRANSPORTATION.

SEATTLE, WASH.—The city council of Seattle has passed an ordinance authorizing the purchase of freight equipment for the Lake Burien municipal electric line.

OAKLAND, CAL.—Resolutions protesting against the proposed new Key Route line which would cut through the Mills College campus were adopted at the annual meeting of the Mills College Club.

RAYMOND, WASH.—The county commissioners have set June 2 as the day for hearing the application of Frank McMean for a franchise for a system of electric railways on all the public highways in Pacific county.

OAKLAND, CAL.—The board upon the recommendation of the roads, bridge and franchise committee, has granted to the San Francisco-Oakland Terminal Railways, a franchise in San Lorenzo, along Telegraph road to the station in that town.

SEATTLE, WASH.—The city council has decided in favor of granting the Puget Sound Traction, Light & Power Company a franchise to extend several Seattle street car lines on the basis of the original franchise and it is expected that the system will be immediately enlarged by this recent concession.

SAN FRANCISCO, CAL.—The board of works has authorized the advertising for bids for the construction of the Stockton street railroad. Bids will be received up to June 1st. In this contract it is proposed to build the road through the Stockton street tunnel and along Columbus avenue to North Point street and thence to Van Ness avenue.

OAKLAND, CAL.—Specifications for the two new steel propeller ferryboats to be built for the San Francisco-Oakland Terminal Railways (Key Route system), in time for the exposition traffic, have been mailed to four shipbuilders about the bay, and bids must be offered by June 1st. It is thought that the boats will cost about $200,000 each.

SEATTLE, WASH.—The first municipal cars of the city of Seattle are now being operated over division A, which extends from Thirteenth avenue West and Nickerson street on the south shore of Salmon Bay to Third avenue and Pine street, a distance of about 4 miles. Division A represents an investment by the city of $379,414 from a bond issue of $800,000 authorized by the voters in 1911. The line is equipped with twelve steel cars of the latest improved construction.

FRESNO, CAL.—An ordinance has been adopted by the board of supervisors granting a franchise to the Fresno Interurban Railway Company to construct an interurban railway along a portion of Fresno avenue. The tearing up of Fresno avenue preparatory to laying the rails along the thoroughfare for the railway is progressing rapidly. Through the Esmeralda vineyard for more than a mile the ties have been laid and over a large part of this stretch the rails are down. J. B. Rogers has promised to have the road in operation by the first of July.

STOCKTON, CAL.—There are persistent rumors that the city lines of the Central California Traction Company are soon to be taken over by the Stockton Electric Railroad Company. The city officials are still pressing the traction company to repair its right of way according to the terms of its franchises. To properly repair those portions of Stockton's streets covered by its franchises would, it is reported, cost the traction company in the neighborhood of $75,000. The company has always pleaded lack of funds whenever the officials have pressed the railroad to live up to its franchise. Monday evening, it is rumored, the principal owners of the traction company held a conference with Paul Shoup. It is reported that the terms of the sale was agreed on at last meeting. A few weeks ago Paul Shoup visited Stockton and inspected the city lines of the traction company.

AUSTIN, TEX.—What promises to be the first of several interurban railways that will be built by the Southern Pacific in its Galveston-Houston territory is soon to be constructed from a point near La Porte to Seabrook, about 14 miles. The proposed line will run along the bay shore where there are many resort homes. It is said that it is planned by the Southern Pacific to enter the interurban field of Houston and Galveston in much the same manner as was done at Los Angeles and Oakland. Whether the trains will be operated by electricity or gasoline motor is not stated. The suburban districts of the two sister coast cities are growing rapidly, and while the electric interurban line that is already in operation between the two points takes care of a large local traffic there is quite a large population situated away from that particular route which is said to be in need of rapid transit facilities

TELEPHONE AND TELEGRAPH.

HOLTVILLE, CAL.—The Valley Telephone Company has applied to the city trustees for a franchise for an exchange in that city.

POCATELLO, IDAHO.—The boards of commissioners has granted a franchise to the Smith Telephone Company to construct and operate a line in Gentile valley.

NAMPA, IDAHO.—An ordinance has been presented by Lone Tree farmers asking for permission to erect a pole line in the city and put in a telephone exchange.

DUNCAN, ARIZ.—J. E. Allen, owner of the telephone system in Lordsburg, has purchased a half interest in the Duncan exchange from James V. Parks, and will become manager of the Duncan system. Substantial improvements in the system are promised.

SPOKANE, WASH.—The Pacific Telephone & Telegraph Company will be obliged to operate without a franchise in Spokane for a period of nearly two months, even if the city council grants the corporation a new franchise at the earliest possible time. The present franchise of the Pacific company expires on June 17th. The proposed new franchise has been published only two weeks and must be published two weeks more, according to the charter, before it can come before the council for the first, second and third readings. During this stage at least 30 days must expire, and in the event of its passage by the council at the end of this 30 day period an additional month must expire before it may take effect.

WATERWORKS

FRIDAY HARBOR, WASH.—This city has authorized a bond issue of $14,000, which has been bought by John E. Price & Company. With the proceeds will be built a gravity water system.

RIVERBANK, CAL.—R. W. Hobart, president of the Riverbank Land & Water Company has completed plans to install a water system in that town.

LOS ANGELES, CAL.—The board of supervisors will receive bids up to June 15th, for a franchise granting right to construct and maintain water pipes in certain portions of Los Angeles county, commencing at the intersection of the Los Angeles-Santa Ana county road with Russell street in East Whittier, and extending in eastern direction along Russell street, to Los Angeles and Orange county line. The Franchise is to extend for a period of 40 years.

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PORTLAND FIRE ALARM SYSTEM.
BY R. P. ROGERS.

OIL SWITCHES AND CIRCUIT BREAKERS.
BY FORD W. HARRIS.

A PIONEER TELEGRAPH LINE.
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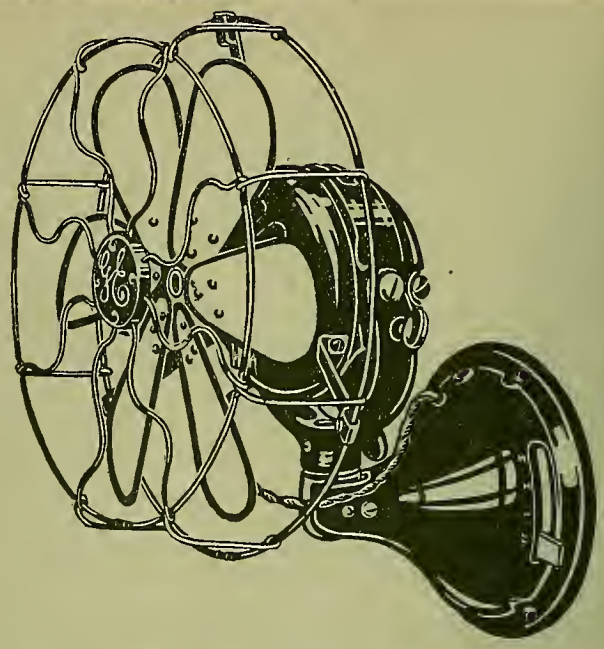
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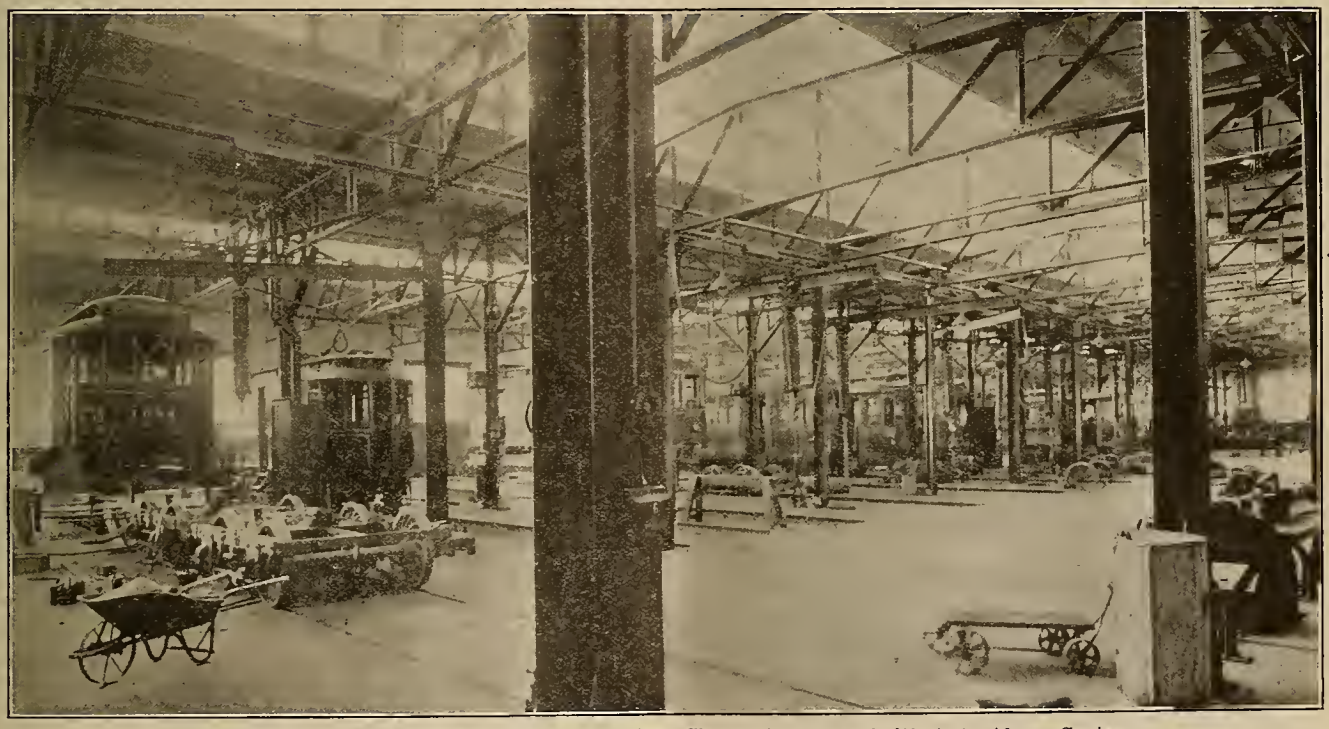
VOLUME XXXII SAN FRANCISCO, JUNE 6, 1914 NUMBER 23

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PORTLAND FIRE ALARM SYSTEM

BY R. P. ROGERS.

(A description of an elastic system of wide application and use, for transmitting fire alarms over telephone circuits. The fire-fighting appliances and the application of this alarm system to car shops of the Portland Railway, Light & Power Company, installation and operation in general, are also detailed.—The Editors.)



Portion of Center Street (Portland) Car Shops Equipped With Auto Alarm System.

The manual telephone fire alarm system of Portland, Oregon, operates over the Home Telephone Company's lines—an automatic telephone system.

It is the Denio system and consists of a fire alarm box connected to the telephone circuit between the telephone and the central exchange, and may be placed upon the street and in the residence, store, factory, church, theatre or school. Direct automatic connection is made to fire headquarters where the fire notification is registered, thus giving direct communication to the fire department, where the alarm is recorded on an approved punch register, within a few seconds.

Installations of this system may be so arranged in hotels, factories or stores, that every guest or employe receives immediate notification of a fire, thus affording ample opportunity both for the saving of life and property.

All troubles—such as grounds, open battery, etc., come in automatically as "trouble alarms" to the central office of the company.

In the fire limits all of the wires of the system are underground and two geographical routes, from the telephone central office and the fire alarm company's central office to the fire headquarters are provided, one being over the Pacific Telephone & Telegraph Company's lines and the other over the Home Telephone & Telegraph Company's line. Either route is selected by the apparatus automatically.

Inside of all buildings the wiring in connection with this system is installed in approved iron conduit. All circuit wires are No. 16 r.c. copper wire.

This system can be operated over manual or magneto telephone systems as well as over an automatic system, without interference with switchboard or telephone service, the only requisite being a working telephone.

The use of telephone lines for transmitting fire alarms in the past has not been looked upon as wholly satisfactory. In the past ten years the telephone has created new conditions and these new conditions call for new provisions and regulations.

It must be conceded that if the telephone is to be used for transmitting fire calls, some accurate method should be employed. The use of a telephone circuit makes possible the individual fire alarm station in every home, store or factory and in the event of a fire will be the means of saving much property by securing prompt assistance.

In trying to telephone an alarm numberless instances could be cited where it was impossible to learn the location on account of the excitement of the person trying to report it, yet reliable statistics covering a number of years show that in the United States more fire alarms are transmitted by telephone than in any other way.

Fire protection is one of the most important problems of the hour, and of concern to every individual. For every two dollars spent on the construction of new buildings in the United States, one dollar's worth of property goes up in flame and smoke, absolutely wiped out and a total loss forever. Notwithstanding the marked improvements for fighting fires, the losses are constantly on the increase, besides a great loss of life.

It is very easy to put out a fire in its incipiency, therefore, the value of immediate notification to fire department headquarters. The first five minutes of any fire are the most important and are worth the next hour.

How few people know the location of the nearest municipal fire alarm box. But if the system is installed in their property they are constantly reminded of the boxes by daily contact.

The system has been in operation several years, and has fully demonstrated its practicability and has received the approval of the leading telephone engineers of the United States and also the National Board of Fire Underwriters.

Systems installed to date are as follows:

Rochester, N. Y. (Manual Telephone System.)
Alpena, Mich. (Manual Telephone System).
Honolulu, (Automatic Telephone System).
South Bend, Ind. (Automatic Telephone System).
San Diego, Cal. (Automatic Telephone System).
Los Angeles, Cal., (Automatic Telephone System).

This description relates to the Denio Fire Alarm System operating over an automatic telephone line.

Residence or Single Box Installations.

The single box consists of a clock movement operated by a push button arrangement. The first movement of the box cuts off the telephone and bridges a polarized relay across the line to take care of any in-coming call. The second movement grounds both sides of the telephone line preparatory to a full release of switches (automatic telephones).

In case of an in-coming call landing on this particular line switch at the same time the button is being pushed or between the time of pushing the button and the building up of the connection to fire headquarters, the polarized relay arrests the movement of the box and the calling party getting no reply, hangs up and repeats his call. The instant he hangs up, he releases the polarized relay, setting the box in motion, which, in turn, takes full possession of the line before he has time to land on this particular switch, the second time. This precludes all chance of interference from either end of the line and makes the operation of the box absolutely positive.

The calling device consists of a trunk character wheel which connects with a level equipped for ten repeaters. This level is connected directly to registers located in the fire headquarters and the central office of the fire alarm company.

No. 1 repeater connects directly with No. 1 register; No. 2 repeater with No. 2 register and so on and in case of two alarms coming in at the same time, the first to land on the repeater level would take No. 1 repeater, and the second would automatically pass over No. 1 and select No. 2 repeater. This level fully equipped with 10 repeaters, would, therefore, be able to take care of 10 alarms sent in—one on top of the other just as fast as one could push the button.

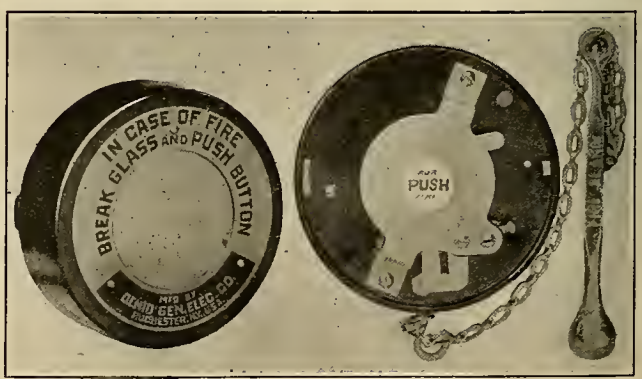
The instant the box connects with the repeater, the box number character wheel is cut into service and transmits and records this particular box number on the tape at fire headquarters and at the central office of the Fire Alarm Company. After this number has been recorded on the tape eight consecutive times, the box automatically releases the call and restores the telephone line to service and the telephone is now ready to either receive or transmit messages, etc.

These trunk lines from repeater to fire headquarters and the central office of the Fire Alarm Company are, normally, on closed circuit. (See route of fire alarm and trouble transmission circuits), and are under constant test for opens, grounds and shorts and besides this are tested twice daily from the central office of the Fire Alarm Company.

Factory Installation.

Factory installations comprise a more elaborate scheme and the equipment consists of the following:

Fire alarm transmitter or master box.
Trouble alarm transmitter:
Local batteries, circuit relays.
Test relays, gongs for warning occupants of building.
Fire and trouble bells to serve as local warning of trouble.
Annunciator for locating fire.



A Factory Manual Box.

Fire Alarm System in Car Shops.

The prime object of installing a fire alarm system at the Center street car shops of the Portland Railway, Light & Power Company, was to provide a means by which the private fire brigade composed of men employed in the various departments of the shops, could be called together for the purpose of holding fire drills at regular intervals and receive instruction in fire prevention and fire fighting. As the distance from some of the departments to the nearest city fire alarm box would necessarily be considerable, it was thought advisable to employ a system by which the city fire department might be called from any one of the departments or buildings. It was decided that the Denio system with the addition of local alarms and a device for operating these for fire drill purposes without calling the city department, was suited to fulfill all the requirements.

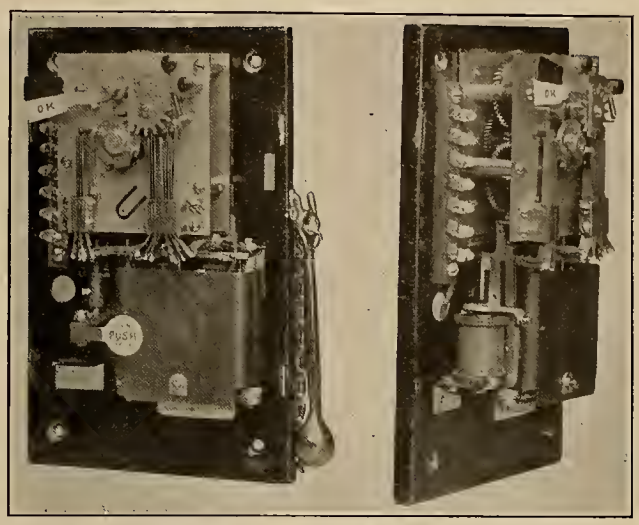
The fire fighting apparatus at the Center street shops in addition to the standard automatic sprinkler systems which are installed throughout, consists of 8 standard fire hydrants fed from a special 8 in. main connected with the city water system, also with a 50,000 gal. gravity tank on a 75 ft. steel tower. A hand hose cart carrying 800 ft. of 2½ in. cotton rubber lined hose and necessary fittings is housed about the center of the group of buildings. Throughout the interior of the several buildings are located single 2 in. hose outlets with a 50 ft. length of 2 in. hose attached to each and so arranged that any point within any one of the buildings may be reached by at least one of these outlets. The fire alarm installation covers the three present buildings which form the shops, all of which are one story high and have a combined floor area of approximately 150,000 sq. ft. The system will later be extended to cover the warehouse, now in course of construction which has a floor area of approximately 50,000 sq. ft. Future structures at this location will also be covered by this same system.

The local alarm system consists of eleven large single stroke electro-mechanical gongs, and twenty-three fire alarm push buttons or stations of the break glass type distributed throughout the various departments of the shops.

Each building has a separate gong circuit and push button circuit with the exception of the general truck and repair shop in which there are two gongs and two push button circuits. This arrangement makes it possible to ring an alarm in any one of the buildings without operating the alarms in the other departments.

At the office of the captain of the employes fire brigade there is a set of drill alarm switches by which the alarm gongs in any one or all of the buildings may be simultaneously operated, calling the fire brigade to any building or section. This set of switches is contained in a small cabinet and is used for drill purposes only.

If any one of the push buttons is operated which would be the case if an actual fire occurred, an alarm is sent in to the central office of the city fire department, indicating there on a tape and by means of a bell, the fact that the alarm has been turned in from this risk. In addition to calling the city department, a local fire alarm box is set in motion which rings the local alarm bells throughout all the buildings, striking a number which indicates the building from which the alarm was turned in, thus calling the local fire brigade to the exact point of the fire. After the push button is operated by the party discovering the fire, the operation of turning in the alarm is entirely automatic and is accomplished as follows—by pressing any one of the fire alarm push buttons, a device



Details of Residence (left) and Factory (right) Fire Alarm Transmitters for Automatic Telephone System.

called the "main fire alarm box" is set in operation. This box is connected with a main line of the automatic telephone and when operating, first takes possession of the telephone line, cutting off the telephone connects itself directly with the city fire department and turns in the alarm as stated above. This operation also sets in motion the local fire alarm box, giving the location of the fire as described.

The wiring for this entire system is in accordance with the requirements of the National Board of Fire Underwriters and little trouble is expected from this source. It is wired on a double loop system so that any circuit may be broken at any one place and still be in operating condition. Any trouble, however, such as a break or grounded circuit is detected by suitable relays cut in on each circuit and connected with a telephone trouble alarm, which, when set in operation, notifies the local office of the Fire Alarm Company of the presence of trouble in a manner similar to that in which the fire alarm box notifies the city fire department. Electrical energy for the operation of this system is obtained from a duplicate set of storage batteries of twelve cells each, so arranged that one battery is charging while the other is supplying current to the system. This battery also operates the time and the recording clocks throughout the shops and is of sufficient size to carry any additional equipment that may be added.

Recording Clocks.

The watchman places a key in this apparatus as he makes his rounds of inspection and the exact time is recorded by a Standard Time Company's station-

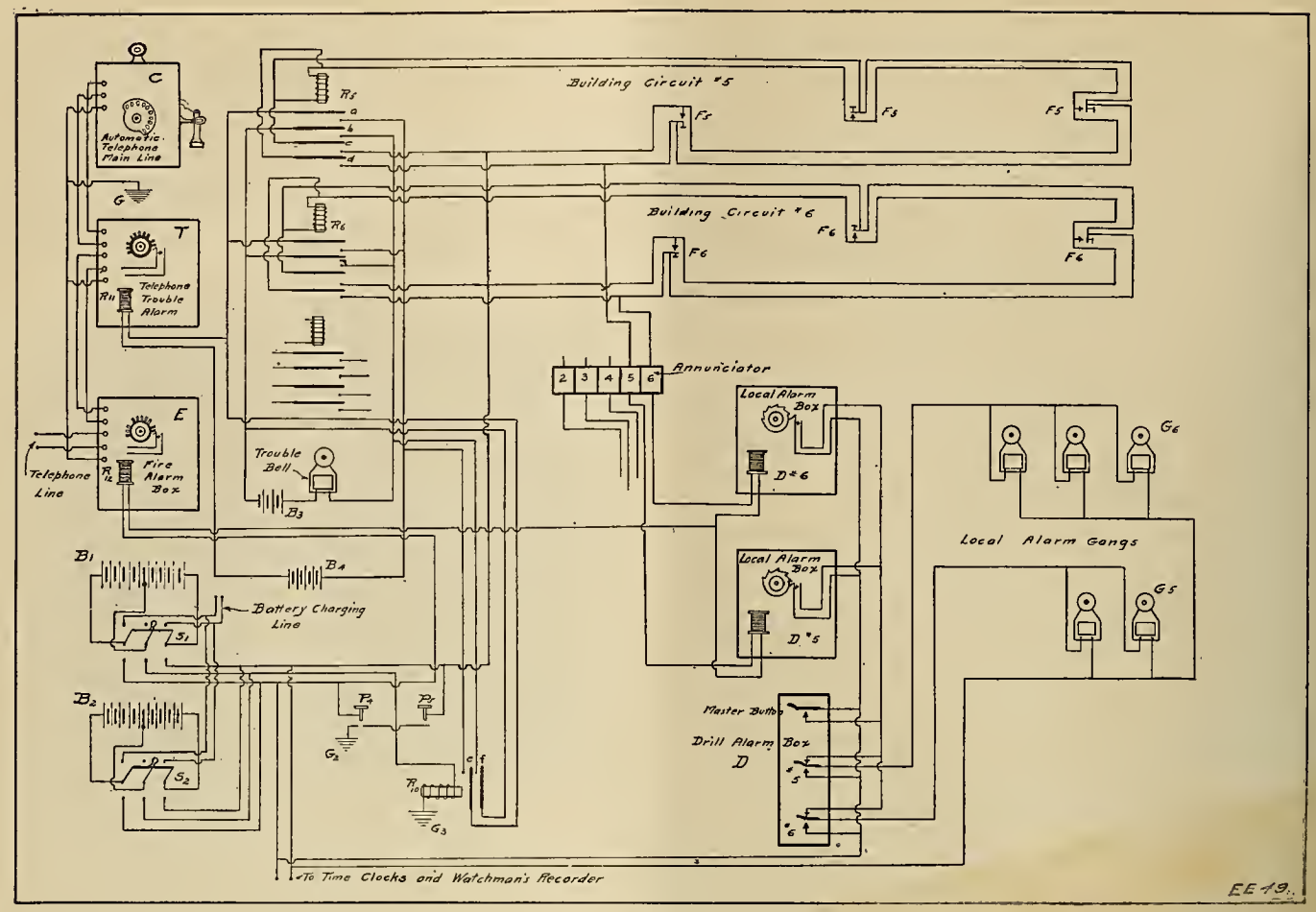


Fig. 1.

ary recorder and an Eco Magneto Clock Company's magneto, thus keeping a check on the operations of the watchman.

All the time clocks in the shops are also synchronized by this master clock.

Operation in Detail.

The operation in detail can best be explained by describing this installation at the shops of the Portland Railway, Light & Power Company, Portland, Oregon.

The system is under constant test and is arranged to sound a fire alarm in every building in the group simultaneously with the calling of the city fire department and it automatically designates the exact building by signalling on the electro mechanical single stroke gongs, the number assigned to that particular building or section of building.

In this diagram only two building circuits are shown. Each building has a separate circuit with the exception of the general truck and repair shop, which is divided into two circuits so that, in case of a fire drill, only the gongs in one building need be sounded at a time and, in case of an actual fire, the building or section in which the fire originated, is indicated.

The equipment as shown on the diagram (Fig. 1), consists of fire alarm box "E," trouble alarm box "T," main line automatic telephone "C," local alarm box D5 and D6, fire drill box "D," annunciator relays R5 and R6 and R10, the above apparatus being located at a central point. The factory manual box push buttons are stations F5 and F6, and the local alarm gongs G5 and G6 are distributed about the several buildings.

Relays R5 and R6 and R10 are of 200 ohms resistance. Relays R11 and 12, the coils of the local alarm boxes D5 and D6 and the annunciator coils are of three ohms resistance each. The local trouble buzzer is also of three ohms resistance. In case of fire the operation would be as follows:

If one of the push buttons F6 be operated, the relay R6 would be shunted and the full strength of the battery B1 or B2, as the case might be, would flow in that circuit.

This would result as follows: Currents from the battery would flow through the relay R12 of the fire alarm box, through the coil of the local alarm box B6, through drop No. 6 of the annunciator to the outside wire of building circuit No. 6, through the push button F6 operated to the other side of the circuit No. 6 thence to battery. By operation of relay R12, the movement of the fire alarm "box E" is set in operation.

The first operation of this box cuts off the trouble alarm "T" and the telephone "C" and bridges the polarized relay across the line to take care of any in-coming call as explained in the preceding part of this article, the mechanical operation of an electrically operated box being exactly the same as one operated manually and it is only 15 sec. from the time the button is pushed to the time the register begins to reel off the notice of fire in fire headquarters and the Fire Alarm Company's central office (Fig. 2) indicating

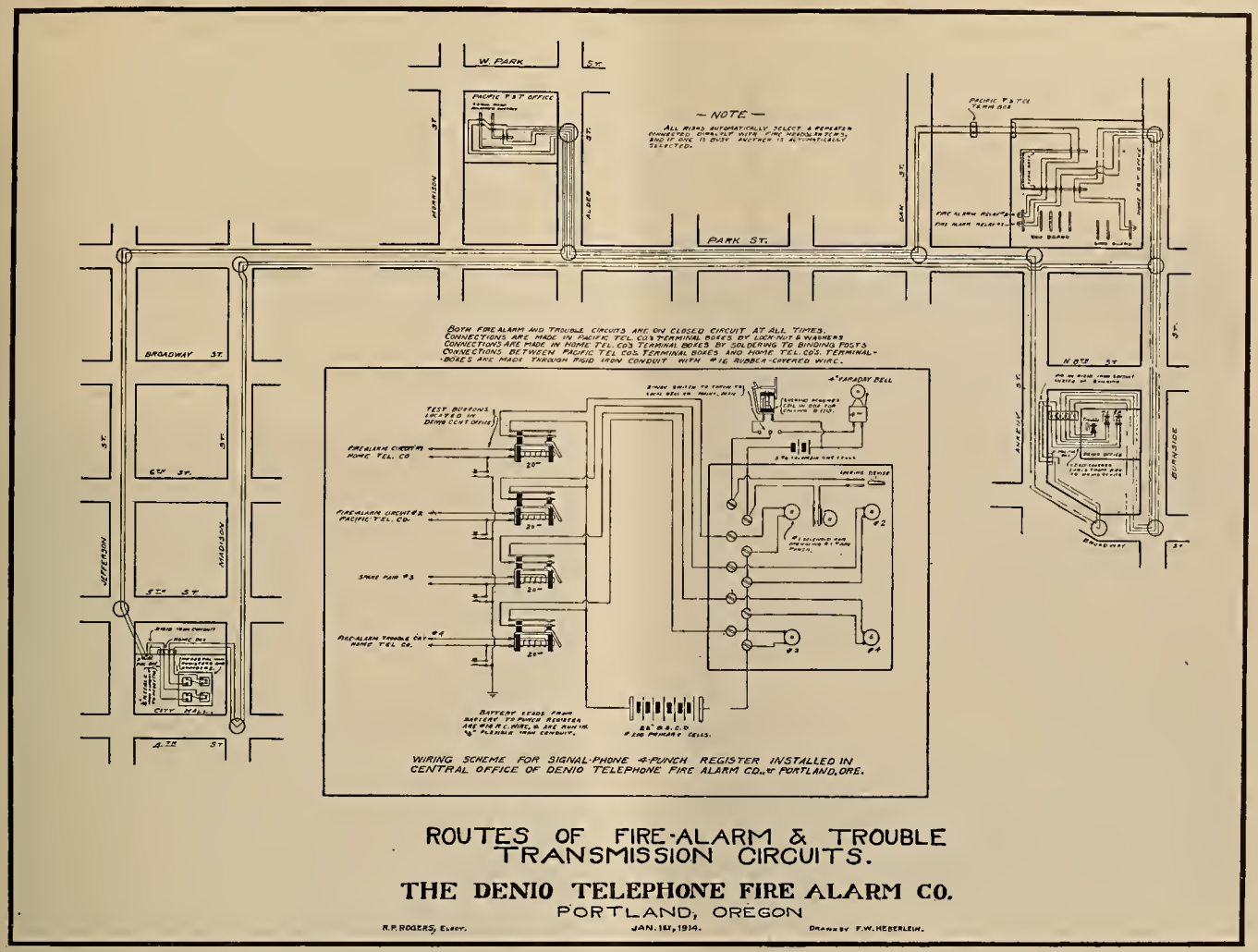


Fig. 2.

that a fire has occurred at the shops of the Portland Railway, Light & Power Company.

The local alarm box has a character wheel which sounds the local alarm gongs throughout the several buildings, giving the building number from which the alarm was turned in.

Fire Drill Feature.

If it is desired to hold a drill in any particular building, take building No. 5 for instance: Key 5 in the drill alarm box "D" is operated five times calling the occupants of building No. 5 alone, to a fire drill without disturbing any of the other buildings. If a general drill is desired, the master key in the drill alarm box "D" is pressed a number of times corresponding to the building in which it is desired the drill be held. This fire drill feature and high efficiency should make this an ideal protector for schools, colleges, etc., both public and private, and, in case of actual fire, since the pupils and teachers would be accustomed to the use of this fire drill feature, they would have no means of knowing whether it was an actual fire or a fire drill and, therefore, there would naturally be little or no confusion.

Trouble Feature.

In case of any trouble on the system, such as the grounding of a building circuit, a broken wire or a run-down battery, the telephone trouble alarm "T" is set in operation notifying the central office of the Fire Alarm Company of the fact that trouble exists on the system. The telephone trouble alarm "T" is of exactly the same construction as the fire alarm box "E" with the exception that the character wheel controlling the automatic telephone line is cut to select a level connected with "trouble" registers located in the central office of the Denio Telephone Fire Alarm Company only.

Operation of Trouble Alarm.

Normally the circuit is closed and relays R5 and R6 hold their armatures attracted. The flow of current in these circuits being very light, the low wound coils R11, R12, D5 and D6 and the coils of the annunciator in the circuit are not energized. Should a break occur on either side of the circuit, circuit No. 5 for instance, relay R5 would be energized, closing contacts A, B, C and D, contact "A" closing the circuit of the trouble alarm relay R11, contact "C" closing the local trouble buzzer and bell circuit on a separate battery B3 and contacts "C and D" closing to form a loop enabling an alarm to be sent in from either side of the break. The action of a break in any circuit would be the same.

When trouble alarm relay R11 is operated the movement is released thereby performing the operation of calling the trouble department of the Denio Telephone Fire Alarm Company and recording the box number on the trouble register tape.

Upon completion of the operation of the trouble alarm box "T," the telephone "C" is automatically restored to working order.

Should a fire take place while a trouble alarm is being reported in, the fire alarm box "E" would immediately take full control of the telephone line and switches and would automatically release the connection built up by trouble alarm box "T" and immediately build up its connection with the level connecting with the registers in fire headquarters.



Equipment in the Office of the Center Street Car Shops Showing Recording and Synchronizing Clock, Magnets, Fire Drill and Call Switches, and Annunciator Locating Fire Alarms.

In this particular case we start out with a trouble alarm to the central office The trouble alarm will take 15 sec. to connect with the register in the central office and 2½ seconds to record two rounds on the trouble tape and is then cut off and disconnected automatically by the master box "E." In 15 sec. time the master or fire alarm box "E" has completed its connection and in 2½ sec. placed a verified record of fire on the fire alarm registers in fire headquarters and the central office of the Fire Alarm Company and it is all done in 35 seconds or 5 seconds less time than is required to make a connection and get an answer over a manual telephone (this is taken from telephone statistics and the average time taken to make connection and start talking with public institutions is given as 110 sec., the average time taken to make connection and get the answer from private residences and business phones is given as 40 sec.)

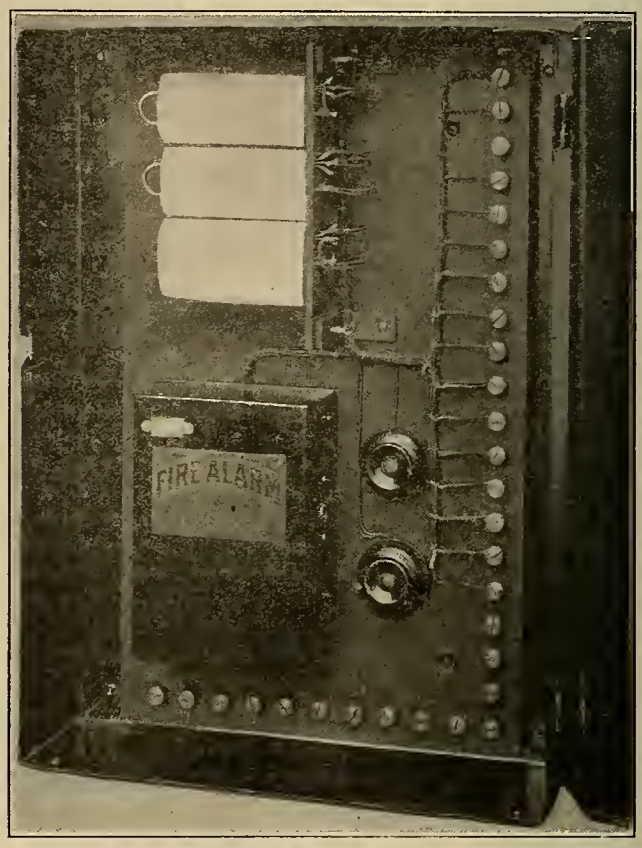
In case of a ground occurring on one of the building circuits relay R10 being grounded at G3, and of 200 ohms resistance, would become energized, closing contact "E" and "F" giving local trouble alarm on the trouble buzzer and operating the telephone trouble alarm "T" sending trouble alarm to the trouble department.

For the operation of this system, two duplicate storage batteries of 12 cells each are employed, connected as shown at B1 and B2, through the double throw switches S1 and S2 so arranged that while one battery is charging, the other battery is supplying current to the system.

The local trouble buzzer is provided with a separate battery B3 consisting of two dry cells and the trouble alarm "T" has a separate battery B4 of 4 dry cells. All of the batteries are tested daily by the operation of test button P4 and P5 described below.

Testing.

For testing one side of P4 and P 5 is grounded at G2. This ground is made at a different location than at G3, then should the ground connection of relay R10 be broken it would be discovered when a test is made. Operating push button P4, tests one-half of the main battery and contacts of ground relay



Factory Panel Equipment.

R10. Operating push button P5 tests the other half of main battery and also relay R10 and batteries B3 and B4. Operating P4 and P5 together shunts the bettery de-energizing relays R 5 and R6, thereby testing relay contacts and trouble alarm signals.

In addition to the above tests, the alarm company is required to have an inspector inspect all risks, once each month, testing for grounds, opens, etc., and both sides of each and every circuit is opened to see that the relay R11 controlling the trouble box "T" will act on an open circuit.

Both sides of each circuit are also grounded to test all contacts and see that each part of the system is in readiness to perform its functions.

This system has been in operation in the city of Portland, Oregon, for one year and in that time has received over its lines 14 fire alarms, three trouble alarms, no false alarms and no failures. The system in each risk is inspected and approved by the Underwriters' Equitable Rating Bureau before being accepted by the fire insurance companies.

OIL SWITCHES AND CIRCUIT BREAKERS.

BY FORD W. HARRIS.

[Concluded.]

The easiest way to do this is to consider what happens when the simplest combination operates. Let us take a single-phase line and consider it as being interrupted by the insertion of three resistance steps and a main break. This can be accomplished by a self contained breaker or by four interlocked mechanisms. Suppose that we elect to use the latter. When a short occurs we cut in the first resistance step by opening the breaker that normally short circuits it. We immediately open the second one and then the third, following this by the fourth which finally clears the circuit. There has been a lot of discussion among the interested engineers on the proportioning of the resistance steps but, having in mind the condition that you have at one instant a low resistance arc of a certain amperage and immediately after a voltage tending to start another arc, it would seem reasonable to make your steps such that the product of the amperage flowing just before the resistance is cut in and the voltage across the gap on the next wave, a constant. If individual breakers, or separate tanks are used for the different breaks, a considerable improvement is effected. In fact it is probable that the factor of safety goes up in proportion to the number of breaks. When, however, the breaks take place in the same tank there is little improvement as the gas from one break is liable to interfere with the next.

There exists a mistaken idea that resistance breakers are of value in allowing the current to die down before the circuit is opened. There is no good reason for this as it is better to let the current die down before the resistance is inserted by the use of time element relays and then when you are ready to operate on the short get it open as soon as you can. The principle advantage in the use of successive steps and a resistance shunting them is in limiting the voltage that tends to build up a new arc as the current reaches zero.

This is a positive advantage and by the use of suitably designed mechanism any circuit can be opened by such successive steps. But to be effective the individual arcs must each be in a separate compartment and the resistance must be quite heavy. The complication of a multiplicity of such breakers is too great to be really practical and the cost of a large power station equipped with a number of such units would be prohibitive. It seems reasonable to carry the designs of the more conventional forms to a higher state of perfection before going to so radical a change in principle.

With that in view it will be instructive to consider the various types now on the market. They do not each have all these faults or even a majority of them, but all the faults mentioned are present in some breakers now being sold commercially. These may be classified as follows:

(a) Insufficient volume of oil. (The oil acts not only as a cooling and insulating medium but also as a damping medium reducing the external manifestations of the explosion just as the force of a bullet is greatly dispersed by sand or water. The inertia of a large body of oil is very valuable on this account, and there are many breakers now in successful service on small plants which for this reason, fail miserably when put on large ones.)

(b) Small contacts. (The contacts on an oil breaker are electrodes for heavy arcs and should be so considered in designing them. Oil breaker trouble can be very much reduced by the use of big arcing tips and rugged contact parts.)

(c) Weak tanks. (The pressures inside a tank are considerable as shown by actual gauge measurements. Weakness may be due to two causes, namely the shape and the material and construction of the tanks. Consider the tank as a steam boiler liable to have a pressure of five or 10 lb. per sq. in. applied to it and the inherent weakness of many designs is at once apparent.)

(d) Improper cushioning. (It is most advisable to have inside the tank a large space filled with air in which the gases of an explosion may expand. With the instantaneous generation of a cubic foot of gas the external effects will be materially less if this gas explosion takes place in a chamber that has 5 cu. ft. of clear air than if it takes place in a chamber having only 10 per cent of this space. There is, however, an added hazard in this air space idea in that the mixture of gas and air is highly inflammable and as the gas often reaches the air far above the ignition point there is likely to be a secondary explosion in this confined space that is as serious as the original or more so.)

(e) Poor insulation. (It seems a little out of place to speak of poor insulation as a part of this particular problem. It is a general criticism of all electrical apparatus and does not at first appear to apply to the general problem of oil switch in any peculiar manner. The phase of the general insulation problem that should be considered is peculiar to oil and air break switches and has not received the attention that it should. This is the fact that the interior of such a device is an active generator of ionized gas. The hot gases from the arc are highly conducting and exposed live metal is dangerous. It is essential that grounded parts such as the tank and cover be treated as if the interior of the breaker were full of conducting gas at all times. While the oil is a good insulator it is a poor isolator as it is liable to be blown violently away and solid insulators without cracks should be used as far as possible to reinforce the oil at critical points.)

(f) Piston action. (During the operation of the breaker the tank fills with gas under pressure. In many designs there results an action exactly like a plunger pump. The tank with its cover form a closed chamber into which projects a plunger consisting of the wooden rod that operates the moving contacts. Suppose that the internal pressure amounts to 10 lb. per sq. in. Suppose further that the rod is 2 in square or has an area of 4 sq. in. There will result an opposing pressure of 40 lb. per tank or 120 lb. total acting upwards on the three rods of a three-pole breaker. If the breaker is designed to open by pushing down on these rods the force must be great enough to overcome the greatest pressure that can possibly be exerted by the internal pressures in the tanks. Where the breaker simply falls open by the weight of its parts this force is rarely great enough and some failures of breakers are due to the contacts being blown together again after the circuit has been partially opened.)

In conclusion it may be said that for moderate sized stations, say those of 5000 kw. and less, the present designs of standard breakers are amply safe and for stations of twice or three times this capacity they may be safe under certain conditions. For larger stations they are safe in localities where they are not exposed to the full force of the generators. The problem is further modified by the nature of the prime mover and the reactance of the distributing system. On very large stations only the best breakers are good enough and there are some breakers that are in excellent repute that are certainly not adequate for the service for which they are being sold.

Much may be accomplished by the use of limiting reactances and the proper grouping of blocks of power. Time element relays assist the breakers but for other reasons, are objectionable. While there will undoubtedly be a tendency on the part of manufacturers to continue to sell certain obsolete types of breaker the problem is now so generally understood among operating men that there will result in the very near future a general revision and redesign of such apparatus to bring it up to date and in line with our present knowledge. No one who has followed the progress of development of other branches of the business can doubt that there will result a better breaker than any now on the market.

Work has been commenced on Balboa substation in connection with the 44,000-volt trans-isthmian transmission line. The requisite excavation is estimated at approximately 4000 cubic yards. The site selected is at the base of Sosa Hill, on the east side, near the present Balboa dispensary and opposite building No. 9—the galvanizing plant of the Balboa shops. The substation is to be situated between the highway and the hill, and this necessitates cutting back into the base of the hill to give the desired clearance. This site was adopted on the recommendation of a committee, which considered the plan of installing the substation equipment and an air compressor plant in the same structure, but voted unanimously against it. The building to be erected will be like the substations now in course of erection at Gatun, Cristobal and Miraflores. The electrical installation will be performed by the Division of Erection.

Alternating current motor cranes for cargo-handling will, for purposes of economy, supplant the d.c. 20-ton French crane and the five cargo-handling Shaw cranes on the steel pier at Balboa. The new a.c. cranes will conform with the 3-phase, 25-cycle standard set for the canal equipment, beginning with the steam electric plants at Gatun and Miraflores, and followed by the hydroelectric station and the motors in the locks. In making these changes, as well as current repairs to the superstructure of the wharf, the superintendent and chief engineer of the Panama Railroad, who controls the docks, is bearing in mind the provisions of the circular of November 11, 1913, that all wooden dock structures in the canal zone shall be destroyed or so altered as to be made ratproof, by January 1, 1919. It will probably be practicable to retain this wharf in service after that date; in any event, the cranes could be transferred to any of the new concrete terminal docks.

A PIONEER TELEGRAPH LINE.

BY JOE BEANE.

(In this article, early construction difficulties met and the methods employed in connection with the installation of a particular line are detailed. Part of this line, though in service more than fifty years, is still used for other purposes. The permanency of red cedar poles is also emphasized.—The Editors.)

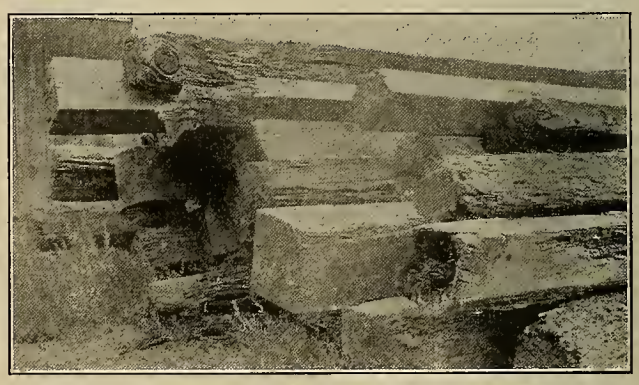
In the years 1861 and 1862, the boom days of Nevada, a two wire metallic circuit telegraph line was constructed crossing the Carson Sink, running west from Carson City to the coast and east through the Carson Sink by the way of Wadsworth, Ragstown, Salt Wells, Eastgate, and Austin, a distance of some two hundred miles.

Forty per cent of the distance is through the desert and alkali flats and some idea can be formed of the magnitude of the undertaking when it is considered that all the material was hauled with ox teams and that it was necessary to carry enough water and feed for an average trip of five days.

The poles used which were sawed red cedar 4 in. sq. top and 8 in. sq. butt, 25 ft. long and spaced 30 to the mile were milled in the mountains above Carson City. They were distributed along the line at a cost of $2.50 per ton mile for cartage.

Where the line ran through the alkali flats the butt was treated by having a hole bored at the ground line and filled with crude oil after which the hole was plugged. Just what the oil was and where it was shipped from I have no way of telling and of all the poles that have been examined by the author none have been found that were actually treated in this way.

The first illustration is of the butts of some twenty odd poles. They were dug up from an abandoned section of the line and hauled in to be used on farmer's extensions to the present telephone system. It will be noticed on examination that the rot which has occurred is almost evenly distributed over the entire section that was in the ground and does not follow the accepted rule of the rot taking place at or near the ground surface. By whittling it was found that the decay did not penetrate to any depth and that the center of these sawn poles was as solid as fresh cut lumber. The section of the line that the poles were taken from took in the extreme conditions; through a sand bank that was never wet to a depth of over 12 in. and an alkali flat that was under water 6 months of the year.

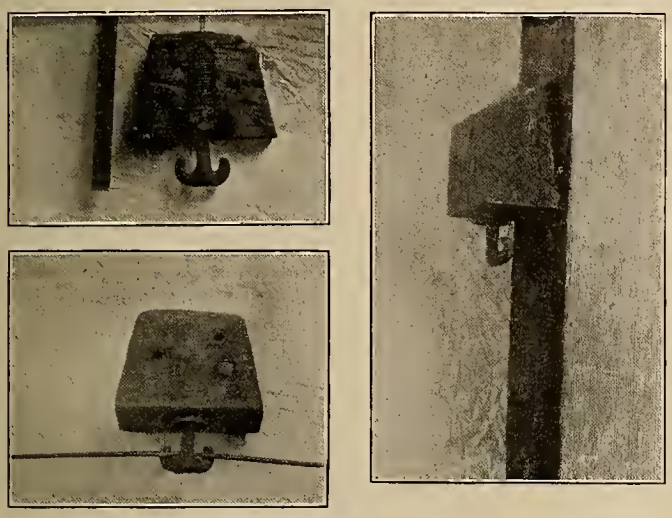


Butts of Red Cedar Poles After Fifty Years Service.

When this line was first put in service all trouble was taken care of by a lineman using a ladder, so

there are no hook marks on the poles but they are pitted in places to a depth of ¾ in. on the windward side, from drifting sand.

In the early days, 1860 to 1870, a great deal of trouble was experienced on account of the pioneers tearing out sections of the line for firewood or to repair their wagons (prairie schooners), as barring sagebrush these poles were the only wood within twenty to fifty miles and in some places it was fifteen miles to sagebrush. For this reason it was necessary to move sections of the line away from the wagon road and the practical route and remove the temptation of taking this necessity from where it could be gotten most conveniently. The line would be moved to a new location but the pioneers headed



Details, Installation and Use of Block Type Insulators.

west with their families would invariably follow and start a new road, at times going miles out of their way. Considering that this was an unmapped country and the constant risk of an Indian uprising they would naturally stay as close as possible to the only sign of civilization—the telegraph line.

Running parallel to a section of this old line is a U. S. Reclamation Service telephone line with the wire strung on sawed redwood poles set in 1905. surface to the depth that it was originally set. In 1913, fifteen of these poles scattered over a 7 mile stretch, but with no two consecutive poles, rotted off at the ground surface were kept from falling by the telephone wires attached and until replaced or reset stood vertical swaying with the wind.

Northern cedar poles that have been in the ground four years show a decided decay at the ground surface and it is estimated that it would take twenty years for the butt to be completely rotted off.

The butts of pine poles 6x6 in. that have been used for temporary connection have also rotted completely within two or three years.

In another illustration one of the poles is shown. The county telephone system has replaced the original wood insulator with two 10 pin cross arms, but the pole is still carrying 16 wires. One of the original insulators is shown still in place.

The original insulator used consisted of an oak block drilled and tapped, and an iron hook set in a gutta-percha bushing screwed in the tapped hole. No tie wire was used but the cramping of the wire by the two prongs of the hook was supposed to hold it from sliding. The blocks were fastened to the pole by three 5 in. cut nails.

About the year 1885 the insulator blocks were superseded by the glass insulator and bracket shown. The bracket is similar to the standard side bracket in use at the present time except that they were not threaded, putty being used instead and the insulator driven on the taper. It was sometimes necessary to wrap the bracket with a piece of rag in order to make a tight fit.

The telephone connection between the Churchill county telephone system (owned and operated by the



One of the Poles Still in Use With Insulator Attached—Also Illustrations of First Side Bracket Insulators.

county) exchange at Fallon and long distance calls outside of the county are made over 30 miles of the original telegraph line converted to a telephone line, glass insulators now being used and runs from Ragtown, a pony express station on the overland trail to Wadsworth. The maintenance for the last three years on this stretch of line has been $23.45 or $7.82 per year with an average of 12 long distance calls per day.

The original wire was No. 9 soft iron untreated and shows practically no depreciation from the weather. The present lines of the original wire have become crystalized from the continual swinging and it is now difficult to make a splice without using sleeves but there is little trouble from breakage on the line.

The aluminum output was 72 1/3 million pounds last year in the United States. There has been a steady yearly increase since 1883, when only 83 pounds were produced.

A bill to prevent crowding on street cars has been reported to the Massachusetts legislature. The bill requires that the passengers standing after the seats are filled shall not exceed 50 per cent of the seating capacity of the car, and that the capacity shall be posted publicly in the car, so that it will be a simple matter for any man with complaint to count and see if the law is violated.

ELECTRICAL MERCHANDISING BY MODERN METHODS.

BY THOS. E. COLLINS.

(In this heart to heart talk which was presented before recent meetings of the Alameda County Electrical Development League and the San Francisco Electrical Development and Jovian League, the author, who is manager supply division, San Francisco office, Westinghouse Electric & Manufacturing Company, differentiates between "dealer" and "contractor," describes the small electrical store as it used to be and as it should be now, and then gives much valuable information regarding advertising, window-dressing, and selling.—The Editors.)

At the outset I wish to make a distinction concerning the general term "electrical contractor," as I believe this is a misnomer. To my mind the term "electrical contractor" conveys the idea of the man who engages in the business of wiring large buildings or erecting distribution systems and other work of this nature.

The man who engages in the business of retailing electrical appliances, motors and electrical commodities generally, I term an "electrical dealer," and while the latter does engage in small wiring work, in the installation of fixtures, repairs, extensions and work of such a nature, yet he is considered a dealer.

The contractors and dealers should differentiate in the use of these terms and generally classify their respective fields of industry a little more closely in order that the public and others may recognize and use the terms properly.

My remarks are directed solely to the electrical dealer, and I want to make my position clear, that should I bring out any points which are in the nature of criticism, that this criticism is intended as constructive, or for the purpose of building up and not as destructive or tearing down. I feel that I am one of you, that your interests are mine and that your success I am dependent upon; consequently, I am not here as a lecturer nor as a teacher to tell you how to run your business, but as a comrade to bring to your attention certain factors in business which built up other firms and which can be utilized by the electrical dealer to his profit.

The subject is a very broad one upon which many volumes have been written and as it is impossible for me to cover all the variable quantities, I feel that I can touch only upon the high spots and advance some ideas for your further consideration and reflection.

The Old-Time Electrical Store.

Let us go back a few years and endeavor to draw a mental picture of the electrical dealer as I saw him when traveling on the road and soliciting his business.

In the country town I walked down the principal street in search of his store—as a rule I did not find it on the principal street unless at the outskirts—usually I discovered him after due and diligent search, secluded either in an alley or in an out of the way place.

I gazed in his shop window; the glass was dusty—more or less. On the side of the wall next to the glass usually hung a huge placard illustrating the various sizes and types of incandescent lamps. The unpapered white walls showed signs of age and distress, punctured here and there with nails or holes. The flooring of this window was uncovered; in the center sat a little second hand motor—I knew it was second hand from its appearance—a rheostat lay on one side of it, an electric iron on the other; a knife switch stood guard in front, and a pair of overalls in the background completed the setting.

As I opened the door a little automatic cow bell announced my entry; the boss was busy reeling off some wire, but said he would be out in a minute, so I directed my attention to his store. On my right lay several coils of wire and a barrel or two of knobs. A step ladder or two helped to hold up the side wall and in the rear was a miscellaneous assortment of junk and a work bench. On the left was a counter about twelve feet in length built of soft redwood; at one end a scale, a pile of booklets and pamphlets, unsorted. Back of this counter were several rows of shelving filled in partly with cartons of incandescent lamps, a fan or two of ancient "vintage," a supply of tapes, knife switches, buttons, magnet wire and other miscellaneous supplies—the balance was empty.

When my time came to open up on the proprietor, I suggested that I would like to sell him some of my electric irons, but I got no further than the suggestion for he told me that my irons were handled in that town by a hardware man up the street and any manufacturer who sold to a hardware man could not sell to him, and so on.

Now—a situation such as I have pictured may not exist in our big cities today, but, nevertheless, it is not overdrawn so far as many localities are concerned, and I am sure all of you have seen the same scene as I have mentioned, and it still exists; yet this man was an electrical dealer and hoped some day to establish himself in a finer store. To me failure was painted all over his place—insofar as becoming a retail merchant was concerned.

Adopting Methods Making for Success.

Let us take another view of handling this same situation by another man who is alert and utilizes the methods of successful merchants in that same town, assuming that this man has purchased the business of the former. He first secures a better location on a street—not necessarily the principal one, but where he can be found without the aid of a compass. His



Preliminary Lay-out—"The boxes are covered with black cloth."

windows are cleaned and kept cleaned; his sign work is neatly done, and on the top of his building (a one story affair) he erects a bill board about 8x12 ft. in size. He illuminates this at night with a few incandescent lamps controlled by an automatic time

clock switch. Posters for this billboard are gladly furnished by the jobbers and manufacturers and the town painter can be utilized when copy is changed or exhausted. Some dealers effectually utilize an illuminated clock with the correct time and it becomes a landmark.

His walls, particularly those of his window, are suitably papered to harmonize with his wares. On the walls are fresh clean display cards, lithographs or other art advertisements neatly staggered for artistic effect.

The floor of his window is covered with linoleum or heavy paper in imitation hardwood. When he displays nickel-plated heating devices, the boxes are covered with black cloth to "bring out" or amplify the polished finish of the appliances.

Next week he changes his window to display fans and other devices. The fans are in operation with an American flag floating in the breeze.

When the display of appliances is at an end, he builds a lighthouse in his window out of knobs, cleats and so forth, flashing its light with a skidoodle socket.

His store is divided in the center by a neatly finished and painted partition screening the junk pile, the work bench, the ladders and the overalls.

The top of his counter is covered with linoleum or other suitable covering.

His advertising matter is carefully assorted and filed in a rack for that purpose—similar to the ones used by the railway companies for their folders. His supply is suitable, a small quantity of each; he does not desire an excess quantity simply because it's free.

His shelving is attractively covered by dark cloth to set out the beauty of his domestic appliances. His excess space is filled—every bit of it—with cartons, some containing lamps, but mostly empty; but, nevertheless, the places looks well stocked and affluent. His display of fixtures are neatly hung and connected for lighting; a dark room or other suitable surrounding can be built for the proper display of fixtures at a small cost—I never saw a dealer yet who could not do a little carpenter work—a dab or two at painting and sometimes hang wall paper, but the latter I suggest leaving to the paper hanger. I mean this however, that if you have the mind and the energy, the necessary capital need not worry you—you can get around that all right.

Specialized Selling and Quality Sales.

This live dealer does not object to handling my goods because the hardware man is trying to butt in on the electrical game. He knows that he is the electrical dealer of that town and when goods electrical are to be purchased, the buyers don't go to a butcher shop or a hardware store to find them. Furthermore, he knows that intelligent information concerning goods electrical can be furnished by him. He has paid attention to the salesman's selling talk when he bought the goods and he uses it on his customer when he is told that she can buy an iron up the street for $2.39. He shows her the merits of his product and gets his higher price, and a customer who goes away satisfied because she has an article of superior merit.

Value of Activity in Public Affairs.

This type of man belongs to the local merchants' association or improvement club, and acts in an advisory capacity to these bodies in matters electrical. The merchants and business men know him and patronize him, and speak well of him.

When I sell him a bill of goods, my advices to our credit manager are that he is enterprising, well spoken of and has the confidence of his fellow citizens and, therefore, worthy of our confidence.



The Completed Window Display is Attractive.

It is not our policy to consign goods, but should he exhibit a centrifugal pump under operating conditions at the Apple Show or County Fair, I am always glad to lend him a motor to operate it. In short, I recognize a live man—a coming business man—and I am glad to trail on behind him—referring my inquiries to him as my agent or dealer.

Electricians or Merchants?

Years ago we were all electricians—how beautiful that term sounded to me—how proud I was to tell my girlish sweetheart that I was an electrician and, of course, my father's friends and my companions considered me in the same class as Thos. A. Edison. Then we all graduated, we became electrical engineers, but now when these terms are sprung on us, we recognize the bell-hanger and the student fresh from college. Today the successful electrical dealer is a merchant. He has laid aside idle dreams and titles and adopts the same selling methods as the clothier, the hardware man and the others of his town.

He arranges his store and stock to be neat and attractive; he pays attention to the salesman's selling talk to learn the features of the articles and is able in turn to utilize the argument that sold him the goods. He becomes resourceful and with it comes increased patronage.

Relationship to Other Lines of Business.

To illustrate further. In an endeavor to practice what I preach, I frequently purchase a hardware magazine—not because I am interested in hardware, but to gain a knowledge of their methods of doing business because the hardware man is the genuine merchandiser handling a thousand and one articles and selling them all. This magazine will devote a page to short snappy slogans such as can be utilized in advertising—another page to an illustration and description of window dressing. In fact, they offer prizes for the next and most attractive window displays. Another page will be devoted to successful salesmanship—showing you how a clerk can put up

an eloquent talk to go to the ball game, but to a customer can only say "absolutely guaranteed" and "110 volts," and I have seen just such lads acting as clerks. Other pages will be devoted to cost accounting, price cutting and other topics of interest.

The day is here, when you have to read and study articles of this nature and adopt them if you intend to successfully compete.

Electricity an Open Book.

The day of mystery is about over in the electrical business—even the school boys are up-to-date in matters electrical; they read electrical magazines and are acquainted with the workings of Ohms law; they delve into wireless and other phenomena, and the questions they sometimes ask put many of us on a barrel for the answer. The coming generation are going to expect many things from the electrical dealer, and he must be prepared to fulfill them.

I don't mean to convey that the merchandiser must be a technically trained man in matters of electricity, but if he can secure as a clerk one of these bright young lads who delve into the science, then he is better able to fulfill the expectancy.

Someone in the establishment must be a merchandiser and if you are capable of handling the electrical problems, then your assistant should study modern business methods. Sometimes we find a man who can happily handle both ends of the business, and, of course, he is doubly equipped.

Need for Correct Business Correspondence.

I might say a word or two on the art of writing business letters. I frequently receive letters in longhand from electrical dealers, but I think a better impression is conveyed by the use of the typewriter and a neat conservative letter head. It's one of the many refinements which characterize the modern business man and the operation of a typewriter is a simple matter.

These pertinent remarks are not directed to the members of this league because you represent or do not represent the characters described. I am endeavoring to do my humble share in the advancement of the industry and I am sowing seed for thought and reflection with the idea that your association spread these further and endeavor to assist and build up our weaker brethren.

[To be continued.]

In the interests of better telephone service on long distance calls, a blotter is being distributed among its subscribers by the British Columbia Telephone Company. A diagram in the form of a clock face is shown which has the sections between the figures shaded to various depths representing the density of the traffic during each hour of the day. The statement on the blotter which best explains its purpose, is as follows: "The dark shaded portions of this diagram denote the periods of the day when long distance traffic is heaviest. Long distance calls can be completed with greater dispatch during hours when traffic is lighter. Appointments to talk at a later time may be made at any time of the day, and the person calling will be advised by the long distance operator whether the appointment is satisfactory to the person called."

RAIL AND STEAMSHIP TERMINAL FREIGHT HANDLING.

BY W. D. PEASLEE.

(Continued.)

Outline of a Particular Problem.

A single wharf will be taken closely following Pacific Coast conditions as found in several places, laid out as in Fig. 2. The incline from the ship's hold to the dock will vary with the tide from a grade of 20 per cent to level. Freight will be discharged from the two side portholes to the lower dock and from the two hatches to the upper dock. It will be brought to the dock by rail and from local shippers by auto-trucks and piled in the outgoing section daily.

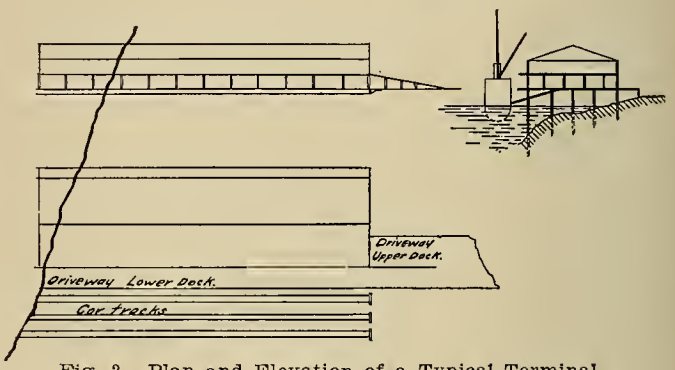


Fig. 2. Plan and Elevation of a Typical Terminal.

On the arrival of a ship the incoming cargo will be unloaded to the dock or dock and frieght cars and the outgoing freight will be loaded from the dock into the ship. The dock will be built of timber, supported on piling, with the vertical clearance between floors 10 ft. The floor of the dock and inclines will be heavy planking.

The ships will carry in incoming cargo of 1250, and will take out a cargo of 2100 tons of miscellaneous freight.

Approximate Labor Costs.

Under the present method of manual loading, unloading, trucking, and piling, studies of actual cases show that for average conditions 120 men with the help of the two ship hoists at the hatches will unload the 1250 tons in 9 hr. from the ship to the dock and will load the 2100 tons from the dock to the ship in 18 hr., trucking an average distance of 240 ft. Stevedore labor is paid $.55 per hour in most places, so the labor cost of handling the 3350 tons between the dock and ship is $1782, or $.533 per ton plus the cost of checkers, weighers, markers and superintendence. This cost it will be noted is for handling between the dock and ship and does not include loading from the dock to the freight cars or vice versa. As the cars are seldom available when the ship is being unloaded the loading from the ship direct to the cars of the re-ship freight is not always possible and the freight is piled on the dock according to its destination and loaded into the cars when they are available. Also freight is arriving at the dock daily and must be piled and held until a ship comes in to take it. For this reason it will be necessary to keep a force of common labor at a lower rate of wages to do this daily work, employing stevedores only to do the rush work of unloading and loading the ships.

Time studies and actual installations show that in loading from the dock to the cars and vice versa

by hand trucks with such a force of common labor a cost of about $.40 per ton will be met, and that such a crew will handle about .55 ton per man per hour, trucking an average distance of 400 ft. As the loading from the dock to the cars and vice versa is steady work it is paid for at from $.20 to $.25 per hr. The rate paid stevedores is high but they are worked at the highest possible rate in order to get the ship away with the least possible loss of time with its resulting standby charges, while the rate paid the common labor is low they cannot be worked at such a rate as the stevedores and it has been found that the labor cost of handling is roughly the same in both cases, ignoring the value of time saved by the rapid handling.

In approximate figures the labor charge for handling local consignments is $.533 plus checking, marking, weighing and superintendence and for consignments that require shipment by rail $.933 plus checking, marking, weighing and superintendence.

Solving the Problem.

Referring to condition 1 of a perfect freight handling system it will be seen that the handling device, to meet this situation best, must be able to go into a freight car, up and down the incline from the ship to the dock when fully loaded, and into any part of the freight hold of the ship. It must be able to get around among piles of freight and through narrow lanes. Any device running on a track is out of the question as tracks cannot be laid easily in the ship or cars and the tracks would use too much valuable storage space. Elevators are used in the ship between decks and elevators or inclined planes may be used between the floors of the dock. The arrangement does not lend itself well to the installation of cranes. Telepher systems work best when they can be run between rows of cars and such an arrangement would require in this case a very large investment and a long transportation and would not, with the present design of ship, be easily installed to serve the interior of the ship. Slides and moving belts are very successful with special freight such as grain and small boxes of uniform size but do not handle miscellaneous freight well.

The Storage Battery Industrial Truck.

The choice of transportation device is then narrowed to a trackless equipment and from the dimensional requirements the storage battery industrial truck is found the most adaptable unit. It is built in such sizes that it will run into the hold of a ship, in the ship elevators, and into freight cars. It is built in capacities from 2000 to 3000 lb. and the 3000 lb. truck will handle 2000 lb. on the maximum incline met here. It will cost according to special features required, from $1000 to $1200 f.o.b. Pacific Coast points. From a safety point of view they must be so arranged that they cannot be operated unless the operator is in his proper place so that any accident causing the operator to leave his position will stop the truck.

The data on a typical truck will show the degree to which these requirements have been worked out by the truck manufacturers:

Capacity	3,000 lb.	Length over body	6 ft. 8½ in.
Speed empty	5¾ mph.	Length of platform	6 ft.
Speed loaded	4¾ mph.	Width	37 in.
Weight with battery	2,000 lb.	Height of platform	18 in.
Battery capacity	192 amp. hr.	Height over all	51 in.
Turning radius of outside wheels	6 ft.		

Two sets of brakes are provided one service set and one set so arranged with the control that if the driver takes his foot from the pedal the power will be shut off and the brakes applied. The power cannot then be applied until the controller is brought to the off position. All bearings are Hess Bright or Timken and the wheels are steel with solid rubber tires. The frame is of commercial channel steel throughout giving maximum strength with minimum weight.

The above data is taken from a standard truck furnished by one of the large manufacturers and is typical in all vital points of the product of several manufacturers.

Industrial Truck Performance.

Time studies and actual installations indicate that these trucks will handle an average of 15 tons of miscellaneous freight per hour a distance of 250 ft. when loaded with 2000 lb. and a little more when loaded with 3000 lb. with two men loading and two unloading. As they will handle 2000 lb. on the maximum incline that load will be used in the following computations. The trucks are narrow enough so that one can enter the ship porthole while another is coming out so the rate of work can be maintained.

Time studies show that two men will load one ton onto such a truck in an average time of 58 sec. and unload it in 62 sec. average. On the first deck of the ship at each porthole four trucks may be loading at all times and the ship's elevators at each porthole will handle trucks at the rate of one per minute, so two loaders on the lower deck at each porthole will keep trucks loaded as fast as the elevators can handle them between decks. We will then have at a maximum rate five loaded trucks per minute leaving the ship from each porthole. This maximum rate cannot be maintained, but it has been found that a rate of one truck every 40 sec. and as the operators become more familiar with the equipment a still better rate may be expected.

This equipment will, therefore, handle 90 tons per hr. from each porthole, with ten loaders per porthole for the two decks. The rate at which freight is discharged from the hatches is governed by the capacity of the ship's hoists and a rate of 30 tons per hr. per hatch can be maintained with most ships with 8 men in the hatch handling and slinging freight.

Thus loading or unloading from the two hatches and both portholes a rate of 240 tons per hr. can be maintained with this equipment and the ship unloaded to the dock in 5¼ hr.

As the unloading of the trucks on the dock is to be done by hand it will require according to local conditions, about the same number of men as are employed in loading the trucks in the ship. A mechanical unloading system would require the use of flats to fit on the trucks which could be taken by a telepher system and distributed. Considering the small force required to unload by hand and the large capital outlay necessary to provide such a system it will not be considered here as a short study will show that it will not be productive of any saving. Twenty men will be required to unload the trucks from the portholes and 8 will take care of those from the hatches. Since the average trucking distance is 240 ft. and each truck

will run about 600 ft. per round trip the time per round trip average will be

Average Time per Round Trip.

Loading	58 sec.	Unloading	62 sec.
Running	90 sec.	Total	3⅓ min.

To this add 1½ min. per trip lost time and it is found that a truck will make an average of one round trip every 5 min. or 12 per hr. and as 90 truck trips per hr. are required from each porthole we have 8 trucks per porthole. To allow for further lost time and emergencies 10 trucks per porthole will be allowed. In the same way it is found that 3 trucks are required at each hatch. No spare units will be needed as the maintenance work on the trucks can be done between arrival and departure of ships.

Crane Equipment on Trucks.

Two of the trucks at the hatches will be provided with motor operated cranes capable of lifting 2000 or 3000 lb. to handle heavy pieces of freight. Inclined ways or elevators will provide a means of transferring freight between the upper and lower docks.

Operating Costs.

The operating cost of these trucks, including operator's wages, interest, maintenance and power varies with the service from $3.50 to $4.50 per day. Taking the high figure an operating cost of $.50 per hr. will be used in these estimates.

Under these conditions the following crew and equipment will be required for the proposed installation:

26 industrial trucks and operators, two of the trucks equipped with cranes.
20 stevedores in the portholes.
28 stevedores on the docks.
16 stevedores in the hatches.

The ship's crew will operate the ship's elevators and hoists. This crew will unload with the equipment outlined 1250 tons of miscellaneous freight from the ship to the dock in 5¼ hr. and will load 2100 tons from the dock to the ship in 9 hr. The cost will be:

26 x .50 x 14¼	$ 85.25 for truck operation.
64 x .55 x 14¼	501.60 for stevedore labor.
Total	$686.85

This is the amount required for loading and unloading of trucks and truck operation. This is a cost of $.204 per ton but does not include weighers, checkers and markers, superintendence, depreciation, taxes, or insurance.

In handling freight between the dock and cars it is found from other installations under similar conditions that four men and one of the above trucks, which can handle 3000 lb. per load under these conditions since there are no inclines, will handle 10 tons per hr. steadily hauling 400 ft. and running into the box cars with the load. This at a cost of, one truck, $.50 per hr.; 4 men common labor, $1.00 per hr. Total $1.50 per hr. or $.15 per ton at a common labor rate of $.25 per hr.

We will assume further that a vessel arrives about every 4 days, that is, 90 per year, so that the total tonnage to be handled is 301,500 per year. Of this it will be assumed that half is of local consignment or origin and that half is to be handled between the cars and dock, so 150,750 tons per year must be handled between the dock and cars. This is 502.5 tons per working day for the common labor to handle. For this work 6 extra trucks will be provided with 24 men. This equipment will handle the freight at this rate easily with one truck and crew operating 5¼ hours per day. The rest of the time it can be used for any work that may develop extra.

Investment Required.

The total equipment of this terminal will be:

30 industrial trucks at $1200, using the high figure	$36,000
2 trucks equipped with cranes	5,000
Charging equipment, elevators, etc., estimated	7,500
Approximate total investment, f.o.b. Pacific Coast	$48,500

On the assumption that the arrival of the vessels is such that none of the unloading is done on holidays the present labor cost of handling the freight between the dock and ship, less the cost of weighing, marking, checking and superintendence is $1782 × 90 = $160,380 per year. Any Sunday or holiday work must be paid for at a time and a half rate which would increase this cost.

On the same assumption as to holiday work the cost under the proposed system will be:

$686.85 x 90	$ 61,816.50
Depreciation, 10 per cent	4,850.00
Taxes and insurance, 3 per cent	1,455.00
Total yearly cost	$68,121.50

The interest, power, operator's wages and maintenance are included in the operating cost of the equipment. This is $.226 per ton for the cost of handling, less weighing, marking, checking and superintendence, a saving of $92,258.50 per year on the cost of handling between the dock and vessel and represents a return of 190 per cent per annum on the investment required.

[To be continued.]

DISTINCTIVE FEATURES OF P. P. I. E. MACHINERY EXHIBIT.

The observations of men who have accumulated exposition experience have been drawn upon to outline features which will reveal to the highest degree the value of selective exhibits in all exhibit departments. In Machinery Hall, the following features will enhance the value of exhibits of machinery:

(1) Wherever practicable, at least some part of an exhibit should be in motion. Many machines can be in actual operation turning out products for the exhibitor's or for Exposition use. Exhibits which do not contain moving machinery can, in this day of easily available electric power, be given some feature of movement, which naturally attracts attention.

(2) Machinery accessories, though not in motion, can be connected or attached to show their use, and their educational value can, in this way, be enhanced.

(3) Machines can be shown in parts, and many fittings and accessories cut to show interior construction, which will be particularly interesting and instructive to all visitors.

(4) Products of machines shown in various stages of manufacture, from the raw material to the finished article, will call particular attention to the machines.

The machinery exhibit as a whole, embodying such of the features just named as are suitable to each individual exhibit, will be of maximum popular interest and instructive value; and it is hoped that no exhibitor will, by failing to embody at least some of the suggestions made, find that his exhibit is not attracting the same attention as that of his neighbor.

LIGHTING METHODS

GAS ARC LAMPS.

BY C. B. BABCOCK.

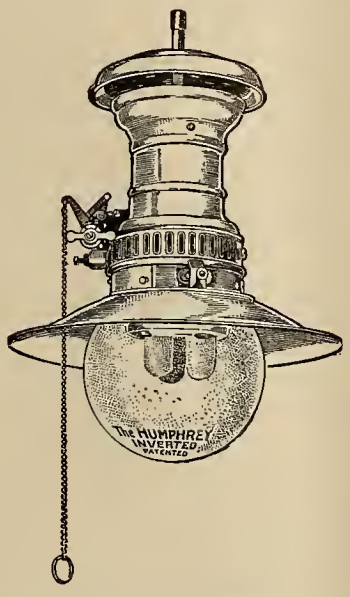
(The profitableness of gas arc lamp lighting is explained and its field stated, also the methods best adapted to secure this business. This contribution from Mr. Babcock, who is manager Pacific Coast office, General Gas Light Company, is the first of a series on the subject of gas lighting.—The Editors.)

What is a Gas Arc? The term is very well known and understood throughout the gas industry, but many electrical men often question the name "arc" as applied to a gas lamp.

Webster's definition of the word includes "electric light formed by passage of voltaic current between two carbon points," so very naturally most people associate the word "arc" with electricity, but though no dictionary, unless we manufacture one of our own, includes the word "arc" as applying to a gas lamp, we can go outside the authority of the dictionary and appeal to common usage.



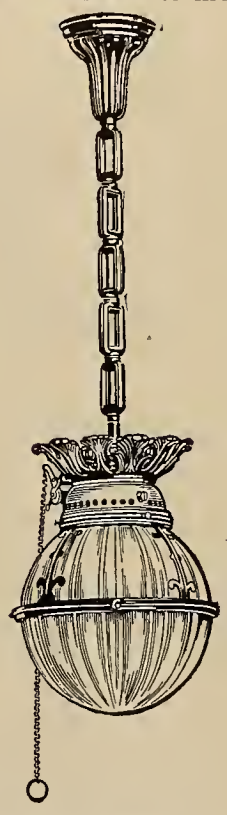
Early Type of Four-Mantle Upright Gas Arc Lamp.



Standard Three-Burner Inverted Factory Arc Lamp.



Modern Three-Burner Indoor Inverted Arc.



Artistic Ball-Pendant Inverted Gas Arc Lamp.

For many years the public has used the term gas arc lamp and because the lamp has stayed in use the term has stuck.

A gas arc is a multiple mantle gas lamp. One that gives light from mantles, only instead of there being only one, there are three, four, or more mantles, clustered in each lamp.

When A. H. Humphrey built the first successful gas arc lamp, upright mantles were used; this type of lamp continued in use for a number of years until the inverted type of lamp was evolved, and this design was adopted because of its greater efficiency, both from a maintenance standpoint and better distribution of light downward.

In this lamp, gas is supplied to a heated chamber in which it is expanded, rarified and brought into a condition for a most intimate mixture with air which has been conducted through the ports of the Bunsen burner. Perfect combustion is thus obtained with the most intense heat which causes the mantles attached to burners to become brilliantly incandescent, much more so than in an ordinary single burner lamp. Above the mantles and around the burner parts is a sort of chimney or stack which helps make the proper draft and is a big factor in making a bright light in the mantles.

Of course there are devices to regulate the amount of air and gas which goes to the burners and to meet any possible fluctuations in the gas supply from the city mains.

There is also a small pilot light, which consumes an infinitesimally small amount of gas, burning in between the mantles continually. By pulling a chain which hangs from the side of the lamp, gas is allowed to flow freely into each mantle and is ignited from the pilot light. Another pull of the chain will stop the flow of gas and turn off the light, at the same time leaving the pilot light ignited.

A round globe surrounds the mantles and softens and diffuses the light.

Gas arc lamps have enabled live gas companies throughout the world to hold their own against electric competition. If the old open flame and single mantle types of burners had been used, gas lighting would have fallen before the onslaughts of its competitor, for with the use of single gas units, maintenance costs were high and efficiency low.

Manufacturers of gas lighting units have endeavored to keep pace with electrical development, and through the gas companies are offering the pub-

lic arc lamps that are not only artistic in design but economical in use of gas. The illumination from this source of light is excellent, giving a pure, mellow, steady light, which does not strain the eyes.

One reason for the excellence of gas illumination is on account of its larger source of light. The electric lamp has a very fine filament from which the



Outdoor Five-Burner Gas Arc Lamp. This Lamp Develops 900 Candle Power or 50 ft. Candles on Low Pressure Gas.

light emanates and unless proper auxiliary equipment is used this brilliant filament is hard on the eyes.

Now, for the commercial value of gas arc lighting. To the straight gas company or allied gas and electric company, I contended that gas lighting is the cream of the business, also giving a greater revenue than any other gas burning appliance, when cost of investment is considered. Furthermore, gas lighting is the best kind of advertising for the utility company. It not only produces revenue for the gas company but advertises its product, as well as conveying to the public the advantage of gas, not only from an illuminating point of view, but for every other purpose for which it is manufactured.

Gas ranges, water heaters and so forth are installed in the kitchen, or in places seldom seen except by the individual consumer, but gas lighting is ever before the eyes of the public.

Cost of Installation.

Gas Range.

5 light meter	$5.00
Meter connections	.50
Piping range	3.75
	$9.25

If a free service is run, another investment by the gas company must be considered, which will probably average a little over $10 for each service.

Gas Arc Lamps.

3-burner type	$7.75
3 mantles at 10 cents each	.30
Freight, etc.	.40
Labor	1.00
	$9.25

We have not mentioned the cost of meter, as practically all business houses are provided with meters either for actual use in connection with some appliance or for emergency purposes.

The Comparative Income.

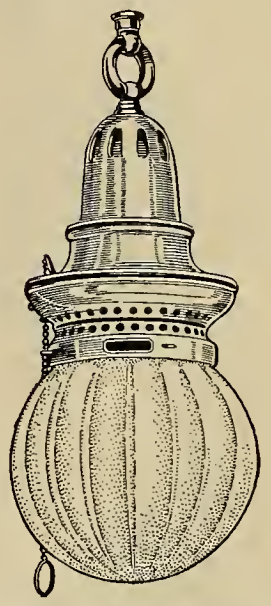
It is safe to assume that a gas range will not consume more than 18,000 cu. ft. per annum, maximum.

Consuming 12 ft. of gas per hr. and burning an average of 3 hr. per night for 310 nights, the 3 mantle lamp would consume 11,160 cu. ft. per annum. I estimate that the average installation would cover at least two lamps, and in this case the yearly consumpiton would be 22,320 cu. ft. of gas. It must be admitted that these conservative though almost incredible figures are convincingly in favor of gas lighting.

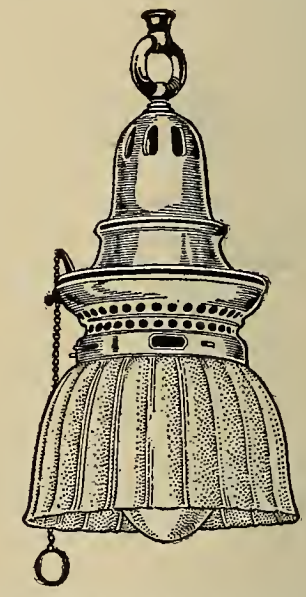
Maintenance.

The experience of the average gas company is that all trouble trips and minor repairs on gas ranges are done free of charge as a matter of service.

Lamps are cleaned and inspected at least every ten days. A man at $2 per day will take care of an average of fifty lamps, and the average cost per inspection



Two-Mantle Inverted Gas Lamp for Use in Low Ceiling or Small Area Business Places.



Single Large Mantle Inverted Gas Lamp, Giving 225 Lumens.

and maintenance will be 4 cents each, including labor and material.

Most companies charge a rental or maintenance of 50 cents per lamp per month, but a minimum charge of 25 cents per month should pay all expense of maintenance. In fact, we may estimate the whole cost on the following basis:

Cost of Lamp Maintenance.

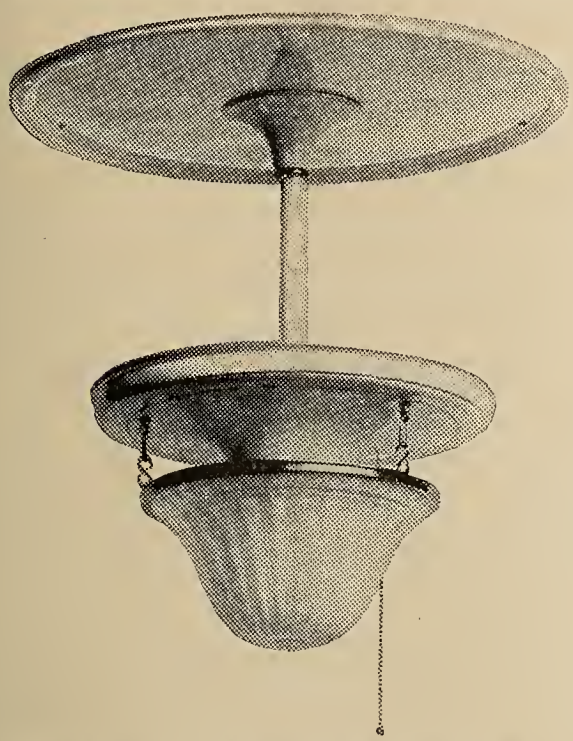
Yearly cost of labor per lamp	$1.44
Average of one mantle per month per lamp (12 mantles at 10 cents)	1.20
Broken glassware and extras (about)	.36
Total	$3.00

Street Mains.

It is a fact that large expenditures for main extensions are absolutely necessary to meet requirements in outlying sections, and this means a heavy expense and drain on the resources of the utility company.

Gas arc lamps sell gas in the down town business sections where mains are ample. No capital expenditure for new pipe is required. Services are put into use and produce revenue from plant which would otherwise be rusting out, in fact, depreciating with no revenue forthcoming to offset this item.

There are constant disputes over meter rentals on account of no consumption shown, but when these meters are put into use by the installation of gas arc lamps, this source of complaint is eliminated.



Three-Burner Inverted Semi-Indirect Gas Arc Lamp. Beautiful in Design and Very Efficient.

The installation of gas arc lamps is with substantial business houses, checks are sent in promptly by pleased consumers, and without doubt the fact that they use gas in their place of business is bound to be a strong incentive to use other gas burning appliances in business as well as in their homes.

Over 75 per cent of the gas companies in the United States and Canada retain title and ownership to the lamps installed, placing them on the premises of the consumer on a rental basis. This plan gives the utility company complete control over the lamps and insures them against neglect and disuse from poor service. Whether the lamps are sold or rented, the utility company should exercise supervision over them and see that they are kept at highest efficiency, and there will never be any question as to the profitable revenue from commercial gas lighting.

It is good sound business policy for the straight gas company or allied gas and electric company to install gas arc lamps. Some few years ago a number of combination companies were reluctant to engage in the business fearing that gas lighting would hurt their electric business. This is not true, in fact, the opposite has been proven conclusively, in that an added impetus to the use of electricity for illuminating purposes has been brought about, and furthermore, the standard of illumination has been vastly improved.

Observe the average city where only one kind of lighting is used, whether it be gas or electricity, and invariably you will find that city poorly lighted.

On the other hand, the city where both gas and electricity are pushed for lighting purposes is the city in which you will find better lighted stores and more profitable business the order.

The best plan for the allied gas and electric company is to divide their commercial department into gas salesmen and electric salesmen, for by specializing the best results will be obtained. In cases however, where the commercial department is very small, it is entirely practicable for the salesmen to sell both commodities.

The most lucrative field for gas lighting is for commercial purposes and street lighting. This is a field peculiarly its own, and one which if intelligently handled by the commercial department, is certain to be productive of remunerative revenue.

Certainly the installation of gas arc lamps in stores, factories, warehouses, machine shops, churches; the installation of outdoor lighting in front of stores, amusement parks, train sheds, docks, piers and for municipal street lighting, is not difficult to obtain with gas lamps when proper new business methods are used.

LIGHTING EQUIPMENT OR FIXTURES.

We must have more co-operation between the illuminating engineer, the glassware manufacturer, and the fixture manufacturer. In practice I have had a number of cases in the lighting of some very beautiful homes, where on inquiring as to whether the lighting is planned one is informed that all the fixtures are in and the only information desired is the size and type of lamp to use. Further inquiry as to who designed the installation reveals that it was left in the hands of the fixture manufacturer. The average individual seems to have the opinion that if the order for fixtures is placed with a high priced fixture house, that is all there is to do.

Examination of the house reveals the result. The fixtures in themselves are very elegant, correct in period, and of splendid metal working; but the equipment of glassware is really abominable. Roughed inside crystal shades and other cheap types of glassware abound.

From the standpoint of the illuminating engineer, the quality of the glassware is a most important item, for this controls the diffusion and distribution of the light. In the cases mentioned, the glassware used generally costs but a few cents a piece.

The fixture men place the period question far ahead of diffusion, distribution of light and protection of the eyes. There is no question that the artistic element is a very important factor, and the period must be correct, but we can have all these and also the protection of the eye and desired diffusion and distribution of light, because there is such a variety of good glassware on the market from which to make a choice; glassware can be secured which will not only harmonize with the fixture, but give all these good qualities.—A. L. Powell in discussion before the Illuminating Engineering Society.

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Refusing Profits

In every family there is a black sheep. Sometimes he is so from choice, at others given a bad name merely lives up to it, or yet again, may really be but neglected by its more ungainly brethren—a Joseph of immeasurable possibilities and importance.

The black sheep of the electrical family will be found to take practically no part in matters of interest to the industry as a whole, and the component parts of this branch will probably be found to be selfish, dissatisfied and even demoralized; conducting a barely profitable business and refusing maximum profit even where proferred or possible.

There is the exception always, but he but goes to proverbially prove the rule.

In lighting, the fixture dealer is, on the majority of installations, the one whose work may make or mar the service, as all the care exercised in properly wiring the building and in providing energy of sufficient quantity and pressure is wasted if maximum results or effectiveness in lighting is not secured.

Though paying for watts the customer wants effective lighting. The wiring and fixtures with their equipment, are a means to that end.

At Jovian and electrical engineering association meetings that branch of the electrical industry which is from the lighting end the most important, namely, those identified with the manufacture and installation of fixtures, is the least heard from.

The spirit of co-operation has not moved on the waters of their indifference.

The fixture man should be cultivated more intensely by the industry as a whole, for the lack of co-operation on his part—the harsh, inartistic, unsuited or improper use of his product—will do more to depopularize the use of electric lighting than any other factor and thus bring that which is eminently satisfactory if used rightly, into an unjust disrepute.

The fixture man is too far out of the fold for his attitude to be fair.

It is no secret that the business of the electric fixture dealer and the retailing manufacturer is comparatively unprofitable and that the same capital and energy expended in other branches of the electrical industry would, if allowed, result in larger profits.

Maybe because it is, perhaps the least profitable, many unskilled salesmen have drifted into these branches, but it is common knowledge that in many cities their object is to get the business without considering the effect of the methods by which it is secured.

Cheapness is shouldering quality for a place and "dog-eat-dog" tactics are altogether too prevalent.

It seems difficult for that branch of the business to display that spirit of co-operation evidenced in the effectiveness of other branches and essential to the success of all, for even where the best has been demonstrated and the customer satisfied that that is what he wants, there are fixture men who will produce fixtures from the bins of cob-webbed antiquity, representing a less expenditure and still smaller profit, and offer them as "just as good."

There is a crying demand for a higher morality in fixture salesmanship and honesty in expounding this doctrine of "just as good."

Nothing is just as good as the best and the sooner the fixture trade recognize this and co-operate together to the end of quality sales, the earlier will that branch of the business be placed upon a more profitable and enduring basis.

A dissociated fixture trade without quality is an economic impossibility.

The electrical industry in general wishes this cheap, unfair competition eliminated that the black sheep of the family may receive the coat of whitewash it now needs and will then have deservedly earned.

Common Practice

In this issue, the California Association of Electrical Inspectors suggest the formation of local common practice clubs in order to attain "a better and more uniform standard of electrical construction and to promote uniform interpretation of the rules which comprise the standard."

To do this would be to place electrical contractors on a more common footing, and if followed out to its logical conclusion should prove an advantage to the trade in general.

The adoption in 1906 by the National Electrical Contractors' Association and the American Institute of Architects of standard symbols for indicating electrical locations on plans, together with their general acceptance, has simplified immensely their uniform interpretation. There can be no question of the meaning of the symbols used.

This is commendable, for it is not the intention nor to the interests of either contractors or architects to have differences, due to misunderstanding or misinterpretation, regarding electrical contracts made between them.

Common practice, standardization, is largely a growth of custom, and the danger exists, therefore, of contracting rules or habits which do not readily change with the establishment of improvements. Common practice not controlled is conducive to conservatism.

The fact might be instanced, that notwithstanding the general adoption of the Mazda lamp, the symbols referred to still have, as their standard, the now obsolete 16 c.p. carbon lamp equivalent.

Adherence to the old order or method is to oppose change and to hinder progress.

Compliance with the existing order or method is to create common practice, and in matters which cannot be questioned and where changes in the materials used are not constantly taking place, this standardization is of great value.

An illustration of the effectiveness of this practice is found in the Ford plant, in which an automobile is completely assembled in exactly twenty-nine minutes after the under frame is placed before the workmen.

Such "common practice" is mighty uncommon.

Dissimilarity is temporarily advantageous to those who discover or evolve a better way of accomplishing any particular end sought. Dissimilar practice may be a mark of superiority and is one of the causes which make for the wide difference in competitive bids.

Another and perhaps more prolific cause consists in the interpretation of ambiguous specifications.

Here then is to be found the second and next logical step in the adoption of feasible common practice —the adoption of standard terminology in the writing of electrical specifications.

Almost invariably, the National Electrical Code is made a part of the electrical specifications, and this is another matter for disagreement, for it is found that the meaning of the Code is largely a matter of interpretation.

The suggestion of the California Section of the National Association of Electrical Inspectors should meet with a hearty response from all those interested, and undoubtedly will be if the ground work for the inauguration and conduct of such common-practice clubs is properly presented.

Memorial Day

The lessons of Memorial Day have also a practical business application for those who will but consider them, giving it a value additional to its prime intent. Primarily it is of course an appreciation of the sacrifice of those who fell in the fight for the Union—for the resulting privileges we now enjoy.

It is nice for the living to keep the grass green over the good and great and the flowers over our loved ones from wilting, but it should be remembered that memory is for the living and has no benefits for the dead.

The first opportunity following Memorial Day should be devoted to an accounting; a justification, excusing, or other mental corroboration of your attitude toward the living.

Are you taking the full measure of those who are doing for you now and so rewarding their service, remembering them, in a manner which shall benefit you both.

It was Robert Ingersoll who made the immortal statement that "Flowers on a coffin cast no fragrance backwards over life's pathway," and who then went on to say that he would prefer those who had alabaster boxes of precious ointment to break them for his anointing during lifetime and not to save them for the process of embalming the inert.

All of which is morbid or not, depending upon your own mental attitude.

And to make the argument of practical value in this work-a-day world.

It is better far to expend money on schools than upon prisons, and as far as foresight can, to make travel upon the highways of the sea safe, than to mourn, nation-wide, an Empress of Ireland or a Titanic loss, and so forth.

Safety First, in the shop and in all walks of life, is essential. The alabaster boxes broken for the anointing of his employees by Henry Ford shows the extreme application of this principle of considerateness for the living, and its mutuality. While the ultimate benefit of this practice is greatly to be questioned, the spirit which prompted it is worthy of commendation. He serves his fellowmen best who most rapidly increases the total wealth of society. Welfare work is not charity, but sound business, as is any means which creates harmony between capital and labor, the two supports of constructive production.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

H. L. Harkness, representing Hughson & Merton, has returned to San Francisco from Los Angeles.

J. O. Presbey, sales representative of the Holophane Works of General Electric Company, is at Salt Lake City.

L. Amigo, of the Cox Electric Company, Santa Cruz, Cal., has been spending a few days' vacation, combined with business, at San Francisco.

W. L. Huber, civil electrical engineer, has moved his office from the Foxcroft building to the First National Bank building, San Francisco.

Miles Steel, salesman with Benjamin Electric Manufacturing Company, has been elected a member of the Illuminating Engineering Society.

Geo. A. Gray, representative of the Crouse-Hinds Company, Chicago, Ill., has returned to San Francisco from a trip through Idaho, Nevada and Utah.

W. H. Heulings, Jr., general sales manager J. G. Brill Co., Philadelphia, who is traveling throughout California, arrived at San Francisco during the past week.

H. R. Noack, president of Pierson-Roeding Co., San Francisco, returned during the week from a several weeks' vacation trip through the high Sierra region.

A. L. Armstrong, associated with R. J. Davis, California sales agent of the Century Electric Company, St. Louis, is visiting the factory of the company, having started from San Francisco during the latter part of last week.

Howard Griswold, formerly assistant engineer for the San Francisco-Oakland Terminal Railway of Oakland, has been made mechanical and electrical engineer for the Central California Traction Company, with headquarters at Stockton.

R. E. Smith, representing the National X-Ray Reflector Company of Chicago, was the guest of honor at the dinner and meeting of the Engineers' and Architects' Association at the Hollenbeck Cafe, Los Angeles, on the evening of June 2nd, and spoke on "Indirect Lighting."

W. D. B. Dodson, secretary of the Oregon Hydroelectric Commission, gave an address before the sixth annual Commonwealth Conference held at the University of Oregon, May 27th, 28th and 29th on the work of the commission during the first twelve months of its existence.

L. E. Hanchett, who was appointed recently to the chairmanship of the board of the Northern Electric Railway to rehabilitate that concern, announces the appointment of **J. R. Wilson** as general freight and passenger agent of the road, succeeding **Samuel Russell**, who resigned.

H. W. Burkhart of Los Angeles, consulting engineer for the Central California Gas Company, was in Visalia, Cal., a few days since, in connection with plans for additions and improvements to the local service, mainly to increase the capacity of the local plant, which supplies gas to several Tulare county cities.

A. A. Isbell, superintendent of construction for the Marconi Wireless Telegraph Company with headquarters at San Francisco, is on his way to Alaska where he will have active charge of the construction of new stations at Cordova, Valdez, Juneau and Nome. **Jack Irwin**, manager of the company in the Pacific Northwest, is at Astoria, Ore., completing the work on the new high power station at that point.

S. R. Inch, general superintendent, and **W. R. Putnam**, commercial agent of the Utah Power & Light Company, and **C. A. Cohn**, superintendent of power stations of the Utah Light & Railway Company, together with **Carl Q. Cannon** of Salt Lake city, attended the convention of the N. E. L. A. at Philadelphia. While in the east Mr. Inch and Mr. Putnam will spend some time at the New York office of the Electric Bond & Share Company, which control the Utah Power & Light Company.

W. D. McDonald has been appointed district manager of the Seattle office of the Westinghouse Electric & Manufacturing Company, succeeding **F. N. Kollock Jr.**, who has resigned as previously reported, to accept the position of treasurer and assistant secretary of the Westinghouse Lamp Company at Bloomfield, N. J. Mr. McDonald was formerly branch manager of the Minneapolis office and has been succeeded there by **C. C. Curry**, who has been appointed acting branch manager.

OBITUARY.

Joseph Addison Sandford, aged 34, electrical engineer for R. Thomas & Sons Company, died at 10:25 a.m. May 21, 1914. He became suddenly ill of appendicitis while on a business trip in New York City a week ago, his condition assuming such a state that medical attention aboard the homeward bound train in the Philadelphia station was necessary. An operation was performed at the hospital by Drs. Hobbs, McCutcheon and Clyde Larkins. Peritonitis developed later, resulting fatally. His death came as a great shock to his relatives and friends. Since coming to East Liverpool four years ago from the New York offices of R. Thomas & Sons Company, he made many friends. He was a member of the Belmont and Kenilworth Country clubs and the Knights Templar. He was born in Ware, Massachusetts, October 17, 1879, a son of Mr. and Mrs. Joseph Addison Sandford. He was a graduate of Ware High School, the Wooster Military Academy and the Wooster Polytechnic Institute. He was also a post-graduate of the latter institute He was married in Ware, November 30, 1910. He was a member of St. Stephen's Episcopal Church. Besides his widow, he leaves one son, Addison Lawton Sandford. The body was taken to Ware, Mass., for burial.

MEETING NOTICES.

San Francisco Electrical Development and Jovian League.

In addition to business transacted by the Jovians at the last meeting an interesting talk was heard from H. W. Cope, assistant manager industrial and power department, Westinghouse Electric & Manufacturing Company, who is superintending the erection of the exhibit of his company at the P. P. I. E.

Portland Section A. I. E. E.

Upon the petition of the Portland section, and the approval of the sections and finance committees, the territory of that section was at the May meeting of the Board of Directors of the Institute extended to include the following: Corvallis, Eugene, The Dalles, Astoria, and Tillamook, Oregon, and Winlock, Washington.

The Jovian Electrical League of Southern California.

A highly interesting and varied program was provided for the entertainment of the Jovians who attended the weekly luncheon on May 27th, the same being presided over by H. F. Anderson. During the luncheon music was furnished by the Hawaiian Royal Entertainers, playing and singing their national airs with unbounded enthusiasm. As special guests of the league, about a dozen boys from the George Junior Republic were present. This institution, as is well known, was founded for the purpose of reclaiming boys who have made mistakes. After the coffee had been served the members were entertained for a half hour by the clever and versatile artist and caricaturist, "Rob" Wagner, who, with lightning rapidity, sketched the many ugly public buildings and statues in Los Angeles, including the lack of proper city planning ordinances and suggesting many ideas for civic betterment.

Utah Electric Club.

The regular weekly luncheon at the Commercial Club Thursday, May 28th, listened to an interesting talk on the

Mexican situation by Apostle Anthony W. Ivins of the Mormon Church, who has been in charge of the interests of the Mormon colonists in Mexico for a great many years, and who has been a resident of that country for forty years. Apostle Ivins spoke intimately of Diaz, Madero, Carranza, Villa and other Mexican leaders, all of whom he has known personally and with whom he has found it necessary in his official capacity to have many dealings. He outlined briefly the history of the country and causes which led up to the present conditions. The club adjourned their regular luncheons for the summer season.

CORONADO MEETING OF JOBBERS.

The regular quarterly meeting of the Pacific Coast Electrical Supply Jobbers' Association at Hotel del Coronado, San Diego, California, was the occasion of a representative gathering of electrical men on May 28, 29 and 30. In addition to the usual golf contests for which these meetings have become famous, a novelty was introduced in the way of a most successful Jovian rejuvenation.

The chief business transacted was a discussion and indorsement of the Stevens bill, allowing the manufacturer to fix the resale price, and a discussion of ways and means of combating the proposed eight-hour legislation in California.

The main party reached Coronado Thursday afternoon in time for lunch. The afternoon was devoted to golf practice, swimming, boating and automobile parties, visiting the beautiful and historic environs of San Diego. The California-Panama Exposition site was of particular interest to many of the visitors. A pool tournament was started in the evening, with informal card games and bowling contests for those so inclined.

Friday morning witnessed the golf contest among the jobbers for the Everready, Coronado and Contractors' cups. As can be noted from the tabulation of scores, H. V. Carter won the Everready and Coronado cups, keeping both of them permanently, as this made the third time that he had earned the right to have his name engraved on the Everready cup and the other was presented by the hotel management. The peculiar condition of the competition for the Contractors' cup granted it to C. B. Hall as the one whose gross score was 18 points worse than the best gross score made.

Jovian Rejuvenation.

Friday evening a magnificent rejuvenation of the Jovian Order was conducted under the joint auspices of Statesmen Alfred May of San Diego and J. N. Colkitt of Los Angeles. Twenty-three unrejuvenated satellites, among whom were some of San Diego's most prominent electrical men, were given a most impressive rendition of the Jovian ritual by the crack degree team from Los Angeles. Too much credit cannot be given for the spirit of co-operation thus engendered between the electrical men of these two southern cities, particularly to the self-sacrifices made by Statesman Colkitt and his degree team.

A sumptuous dinner at the Hotel del Coronado preceded the rejuvenation, over sixty Jovians sitting down to the tables. Carl H. Heilbron, president and general manager of the Southern Electrical Company, presided in his usual able manner as toastmaster. Responses were made by H. V. Carter, R. D. Holabird, F. H. Leggett, W. L. Goodwin, H. C. Ayres, A. H. Halloran, J. N. Colkitt and A. H. Elliott. John J. Portley favored the crowd with some beautiful songs which were greatly appreciated.

After the dinner the degree team took the candidates in charge and saw to it that each neophyte emerged as a fully rejuvenated being. The personnel of the team was as follows:

Jupiter, J. G. Pomeroy
Neptune, R. B. Clapp
Vulcan, L. E. Darrow
Pluto, T. E. Burger
Mars, A. L. Spring
Apollo, H. B. Hall
Hercules, K. E. Van Kuran
Avrenim, C. H. Carter
Mercury, C. L. Lamoree

Imps: B. F. Kierulff, W. H. Lane, H. C. McCutchan, W. A. McNally.

With but three exceptions all the members of this team traveled the 250 miles from San Diego to Los Angeles and return for the sole purpose of taking part in the rejuvenation. To their enthusiasm and co-operation a large part of the success of the rejuvenation may be ascribed.

Following is a list of the candidates who are residents of San Diego unless otherwise noted:

H. C. Ayres, president Ayres Electric Company.
J. P. Boring, Orange, Cal.
R. A. Bartling, Hartwell Electric Co.
H. H. Barter, elec. engineer, Panama-California Exposition.
C. J. Brown, representative Electrical Workers Organization.
R. C. Cavell, draughtsman, San Diego Cons. G. & E. Co.
D. M. Crist, assistant city electrical engineer.
L. B. Collins, Collins Electric Company, Coronado.
W. W. Cott, Edison Lamp Works of G. E. Co., Los Angeles.
G. F. Cunningham, Cunningham Electric Company.
F. S. Hartwell, manager Hartwell Electric Company.
S. L. Hall, purchasing agent, Southern Electric Company.
W. H. Kaemper, Independent Electric Company.
L. M. Klauber, elec. engineer, San Diego Cons. G. & E. Co.
C. C. May, purchasing agent, San Diego Cons. G. & E. Co.
R. P. Moses, Moses Electrical Company.
Thurston Owens, manager, San Diego G. & E. Appliance Co.
John J. Portley, representative F. F. Foster Co.
R. L. St. John, Bay City Equipment Company.
Frank A. Sinks, Electrical Equipment Company.
E. C. Schaffer, Schaffer Electric Company.
H. B. Steventon, assistant manager, Electric Equipment Co.
J. F. Zwiener, Hartwell Electric Company.

Golf Contests.

Saturday morning the manufacturers played for the cup presented by the jobbers, R. B. Clapp winning the coveted honor. The jobbers also competed for the Patton and the copper cup. R. D. Holabird, member of the committee, getting low score and permanent possession of the former. Meanwhile the ladies putted, Mrs. C. H. Carter winning the silver cheese dish.

The pool tournament was won by H. B. Hyde.

Jobbers.

	Everready. Gross.	Contractors. Net.	Jobbers. Gross.	Patton. Net.
Berry	113	103	109	114
Burger	104	104	103	102
Carter, H. V.	95	100	102	108
Carter, C. H.	...	...	104	106
Graham	122	110	144	132
Goodwin	98	103	91	96
Hillis	102	111	92	100
Holabird	93	102	83	91
Hall, C. B.	111	101	124	114
Leggett	103	108	95	99
Taylor	139	121	124	106

Manufacturers.

	Gross.	Net.
Gregory	100	95
Van Kuran	107	102
Clapp	89	92
Lauritzen	105	111
Oakes	113	103
Poss	119	107
Hall, H. B.	117	105
Cott	126	108
Halloran	147	129
Mathews	103	103
Murray	113	103
Colkitt	131	113

The festivities were brought to a close with the golf dinner on Saturday night when the cups were presented to the winners. T. E. Burger presided at the table as toastmaster. These speakers included H. V. Carter, H. T. Matthews, R. D. Holabird, A. H. Halloran, R. B. Clapp and A. H. Elliott. Those seated at the table were:

Airey, Mr. and Mrs. F. J.
Berry, Mr. and Mrs. W. S.
Boring, Geo. A.
Burger, Mr. and Mrs. T. E.
Case, J. O.
Carter, Mr. and Mrs. C. H.
Carter, H. V.
Colkitt, Mr. and Mrs. J. N.
Cott, W. W.
Elliott, A. H.
Gilson, Ross
Goodwin, W. L.
Graham, N. W.
Gregory, S. B.
Hall, Mr. and Mrs. C. B.
Hall, H. B.
Halloran, A. H.
Harris, D. E.
Hillis, C. C.
Holabird, R. D.
Hyde, P. B.
Lamoree, C. D.
Lane, W. H.
Laurtizen, Hal.
Leggett, Mr. and Mrs. F. H.
Mason, Mr. and Mrs. C. T.
McCutchan, H. C.
Matthews, Mr. and Mrs. H. T.
Montgomery, Mr. and Mrs.
Murray, F. H.
Norton, E. A.
Oakes, Mr. and Mrs. R. F.
Owen, Miss
Poss, Mr. and Mrs. Fred.
Quinn, F. J.
Rawls, R. B.
Reed, P. C.
Reynolds, Duncan
Spring, A. L.
Taylor, Sam'l.
Van Kuren, Mr. and Mrs. K. E.
Wiggin, C. E.
Young, Carl

CALIFORNIA ASSOCIATION OF ELECTRICAL INSPECTORS

Section of N. A. E. I.

C. W. Mitchell, President. Arthur Kempston.
Wm. G. Pennycook, Vice-Pres. B. C. Hill, Executive Comm.
John W. Carrell Secretary-Treasurer, 55 Fulton, San Francisco.

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correllate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

By the Secretary.

Practical men demand practical results. They are beginning to demand such results from the C. A. E. I. Many suggestions have been made along the general lines that a common practice club be organized in each inspection district having for its object to secure a better and more uniform standard of electrical construction and to promote uniform interpretation and enforcement of the rules which comprise the standard, and that the C. A. E. I. correlate the results of the several clubs.

The C. A. E. I. organized for the purpose of standardizing the common practice, based on the N. E. Code, invites all practical men to aid in any practical way which appeals to them. The association can be relied upon to perform its part, and will in all matters adopt the most highly developed, most clearly set forth opinion or schedule from whatever source. Action along these lines is suggested.

Questions and Answers.

Question 1 (a)—Under what N. E. Code rule can the use of rosettes be required to attach pendant cords to a system of wiring? (b) What rule prohibits the attaching of more than one cord to the same rosette? (c) What rule prohibits the decoration of pendant cord with tissue paper and gauze?

Ans. 1.—No rule requires the use of rosettes but 32 (g) mentions same. However, strain of cord must be off wires. There is nothing mandatory in the Code to prohibit more than one flexible cord from being attached to the same rosette or to prevent decoration of cords but consider both conditions hazardous and would not allow same.

Ans. 2.—The Code does not require a rosette but does require substantial support for the cord; does not by actual words, but does by inference and intention, prohibit both the last named conditions.

Ans. 3.—There is no N. E. Code rule making it mandatory to use rosettes. By inference only do the rules indicate that rosettes should be used. See Rules 32 and 71. There is no Code rule prohibiting more than one cord from being attached to the same rosette and none prohibiting the decoration of cord with paper and gauze.

Ans. 4.—I consider Rule 32 to plainly imply that rosettes or some similar method of attaching cords must be used, also that the attaching of more than one cord to the same rosette and that the decorating of cords with tissue paper, etc., is a hazard which rule 32 is intended to prevent.

Ans. 5.—Nothing mandatory concerning the use of rosettes. 71 (e) would be one rule to prohibit the attaching of more than one cord to the same rosette as it would be impossible to tie two knots in the same one. No rule prohibits use of decorations on pendant cords but intention to prohibit same is plain.

Ans 6.—1 (a) No. 1 (b) Yes. 2 (b) Yes. Not by actual statement but by inference.

Ques. 2.—Under Rule 26 (o) does No. 0000 have to be supported every 60 ft. or every 80 ft.

Ans. 1, 2, 3, 4, 5 and 6.—Every 60 ft.

Ques. 3.—Rule 23 (f), paragraph No. 2: "For circuits having a maximum capacity greater than that for which enclosed fuses are approved, circuit breakers alone will be approved." Does the word "alone" mean "only?"

Ans. 1, 3 and 6.—Yes.

Ans. 2.—Yes. The rule means circuit breakers only will be approved; but since the publishing of the 1913 Code the Underwriters' Council has made provision for the banking of fuses.

Ans. 4.—The rule evidently means circuit breakers only if on circuits where fuses are not approved.

Ans. 4.—Yes, if on circuits where fuses are not approved.

Ans. 5.—Rule 23 (f) paragraph 2, meets a condition for which fuses large enough are not manufactured and for which circuit breakers "only" will be approved. Also see Rule 67 (c), paragraph 2.

NEW CATALOGUES.

Pressed Steel Case Transformers are fully described and illustrated in Bulletin No. 1280 issued by the Pittsburg Transformer Company, Pittsburg, Pa.

The Wagner Electric Manufacturing Company has published an edition of their Manual of Electrical Testing in miniature form. The Bulletin is No. 104, measures 3½x5 in. and contains all the information in the large size bulletin.

The Ohio Brass Company has issued a splendid cloth bound catalogue, No. 14 of 1914, containing more than six hundred printed pages illustrating and detailing their lines of Electric Railway and Mine Haulage Materials, High Tension Insulators and Supplies. In addition to catalogue information it contains much technical data of interest in connection with the installation and use of these materials.

TRADE NOTES.

E. S. Knight Electric Company of Portland, Ore., has obtained the electrical contract for the Bishop Scott School, Yamhill, Oregon.

The American Electric Company has obtained the contract for the electrical installation in the Brown Apartment House, located on the southwest corner of Yamhill and Lawnsdale streets, Portland, Oregon.

The Hammond Lumber Company has purchased the following Crocker-Wheeler Company's motors for use in its lumber mill at Mills City, Oregon, from D. D. Poppleton, Portland, Oregon. The motor equipment is as follows:

Squirrel Cage Type.

1—50 h.p., 440 volt, 3-phase, connected to edger.
1—10 h.p., 440 volt, 3-phase, connected to stacker.
1— 3 h.p., 440 volt, 3-phase, connected to unstacker.
1—7½ h.p., 440 volt, 3-phase, connected to transfer chains.

Slip Ring Type.

2—10 h.p., 440 volt, 3-phase, connected to rolls.
1—7½ h.p., 440 volt, 3-phase, connected to rolls.

There will also be installed a mono rail and transfer cranes for handling lumber in this mill. This part of the system will operate on a d.c. 250 volt system. Power is derived from water power at the plant.

Bids for the Fresno, Cal., electrolier street lighting system were opened on Monday, June 1st, NePage, McKenny Company being the lowest bidders. The various bids were as follows:

	Pressed Copper.	Pressed Steel.	Cast Iron.
Turner Company	$67,964	$63,312	$63.165
Woodhill-Hulse	63,000	57,000	56,000
H. S. Tittle	.....	.....	57,360
Power Equipt.	71,500	64,800	62,800
Pacific Fire Ext. Co. ...	55,462	49,613	53,114
Newbery-Bendheim	57,000	51,412	54,500
California Elec. Co.....	54,500	47,900	49,300
NePage-McKenny	49,700	44,200	45,600

The equipment calls for the installation of 487 electroliers and necessary conduits. The question as to which type of standard will be adopted was taken under advisement.

NEWS NOTES

INCORPORATIONS.

BURNS, ORE.—Articles of incorporation have been drawn for the Harney Hydroelectric Company with a capital stock of $250,000. The company is organized for the purpose of taking over the J. Edwin Johnson holdings in the power site filed on the North Fork of the Malheur River about 20 miles north of Drowsey. The principal office will be in Burns.

FINANCIAL.

SAN FRANCISCO, CAL.—Combined earnings of the Great Western Power Company, the California Electric Generating Company and the City Electric Company for April, 1914, show a loss of $4275 in gross and $4299 in balance after guaranteed dividends, compared with April last year. This is due to the fact that the contract by which the Great Western Power supplied 5000 horsepower energy to the Pacific Gas & Electric Company, amounting to about $20,000 a month, has expired and revenue is no longer being received from this source. The April statement shows that the Great Western Power has already overcome three-fourths of this loss, and it is stated that by the end of July all of it will have been overcome and monthly reports will again be showing increases over the corresponding months of 1913.

ILLUMINATION.

TILLAMOOK, ORE.—The Tillamook Electric Light & Fuel Company has been granted a franchise to construct electric lines in this city.

BOISE, IDAHO.—The Idaho Power & Light Company has been awarded the contract for supplying current to the new arc street lighting system.

RAYMOND, WASH.—The county commissioners have granted to W. P. Cressy a franchise to use the roads between South Bend and Raymond for gas mains.

NEHALEM, ORE.—An election has been called for July 15th, for the purpose of voting bonds for the purchase of a water system and the construction of a municipal electric light plant.

CENTRALIA, WASH.—The Vader Gas & Fuel Company, a new corporation, has been granted a 15 year franchise by the Vader council to operate a plant in the town, for furnishing gas for illuminating purposes.

AUMSVILLE, ORE.—At the special election on the electric light franchise the measure carried. The Aumsville Flour Mills will begin construction work in a few days. The city will install about 30 street lights.

SAN FRANCISCO, CAL.—A contract has been entered into by the Pacific Gas & Electric Company with the Schaw-Batcher Company Pipe Works for two improved Jones oil gas sets, two primary scrubbers and three secondary scrubbers at Potrero gas works on W. Delaware street, for $41,183.

COVINA, CAL.—The contract for the installation of metal lighting posts and appurtenances for lighting Badillo avenue, fram Baranca to Hollenbeck streets and portions of citrus avenue and Navilla place have been awarded to the Newberry-Bendheim Electric Company, for $11,948, complete.

PORTLAND, ORE.—The Northwestern Electric Company is erecting large steel arches at every corner from Yamhill to Burnside street, on Third. The arches are to be illuminated in an artistic manner. These arches rest on four concrete footings, one on each of the four street corners, and the four arches are curved gracefully to a common point in the middle of the intersection of the streets. The arches being sufficiently high to clear all traffic, including the street cars and trolley system. The property owners along the street pay a monthly rental for the arches, which covers maintenance and lighting.

SAN DIEGO, CAL.—Under a decision rendered by Judge C. N. Andrews in the superior court, damages cannot be collected from an electric light corporation which turns off light or power for the non-payment of bills. The decision was made in the suit of George E. Kerns of the Casino Amusement Company against the San Diego Consolidated Gas & Electric Company. Kerns operates a moving picture theatre on Fifth street and brought suit in the justice court early this year for damages because the electric light company had turned off his power on December 19th, leaving him without light. This act, he claimed, injured his business. Justice of the Peace Solon Bryan gave Kerns a judgment for $50. Judge Andrews reversed the decision on the ground that the corporation had the right under contract to turn off the power if bills were not paid.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company was made defendant in a suit for $139,934 when the Security Investment Company filed an action against the former corporation to recover that amount for alleged damages to the investment company's building. The Pacific Gas & Electric and the Security Investment Companies occupy adjoining buildings on the north line of Sacramento street, between Montgomery and Sansome. The company has a power plant there and the investment concern an office building. It is said by the plaintiff corporation that the vibrations of the machinery in the power plant have damaged the investment company's structure to the amount mentioned in the complaint. The complaint recites that the gas company has threatened to excavate with a view of enlarging its plant, so an additional $25,000 damages is asked if the defendant makes such a move. The plaintiff wants a perpetual injunction to restrain the gas company from constructing a larger plant.

SALT LAKE CITY, UTAH.—City Attorney Harper J. Dinniny made a report to the city commission last week declaring that the special lighting improvement law passed by the state legislature of 1913 permitting cities to create special lighting districts and assess the cost of installing and maintaining special street lighting against property owners is impractical, if not impossible in its provisions, in which he pointed out numerous defects. He reports that it is not in line with other state laws referring to public improvements, and recommends that no action be taken to make the provisions of this law effective in Salt Lake until it can be amended so as to harmonize it with the present statutes pertaining to special assessments. The law was passed by the legislature to give property owners in the business district and in residential districts an opportunity to improve them by installing special ornamental lighting, and to divide the cost of these installations equitably between the various property owners benefited. Several of the city's most progressive business men who were instrumental in having the 1913 law passed are arranging to have such amendments made at the next session of the legislature as will be necessary to make the law effective.

TRANSMISSION.

GOLDENDALE, WASH.—The Pacific Power & Gas Company has been granted a franchise to construct electric transmission lines upon the public roads in Klickitat county.

MORGAN, UTAH.—The power plant owned by the Como Light & Power Company, located near the narrows in Hard Scrabble Canyon, has been purchased by the Utah Power & Light Company, with headquarters in Salt Lake City.

SAN BERNARDINO, CAL.—The board of supervisors of San Bernardino county have granted the Southern California Edison Company a franchise to construct and operate an electric distributing and transmission system under and along certain public highways in that county.

PHOENIX, ARIZ.—Surveys for a line of the Falls Power & Electric Company are being made, and work will begin soon. The system will comprise eight miles of main lines at 4000 volts, 17 miles of secondary lines at 2200 volts, and a local service will be operated both for light and power at 110 volts.

TUCSON, ARIZ.—The transmission line of the Tucson Gas, Electric Light & Power Company, which has just been extended to Sauharita ranch, a distance of 10 miles, is to be further extended to Rillite Valley. Estimates for the work on the power plant and power plant machinery to be installed call for an expenditure of about $90,000.

SEATTLE, WASH.—With a view of establishing a central power plant on the Little Busttna River along the line of the proposed Alaska railroad, the Stone & Webster Engineering Corporation has dispatched a man to make investigations. The plant will furnish power for small quartz mines. The construction of the plant will cost about $200,000.

MARENGO, WASH.—The Pacific Power & Light Company is building a new transmission line from Dayton to Marengo. This line is 18 miles long and operates at 66,000 volts. It is a 3-phase system, using No. 4 stranded iron on combination suspension and pin type insulators. At Dayton there will be located one 200 kw. 6600-66,000 volt transformer, and a 150 k.v.a. transformer at Marengo, 66,000-6600 volt.

YREKA, CAL.—The California-Oregon Power Company is constructing extensions of its lines in the country south of Montague for a distance of 20 miles. The work is to be continued on to Weed before completed. The section now under construction is to be completed by July, and its chief purpose is to supply power for irrigation pumps on the many farms that are being developed in the district. The present extension is from the pumping station of the Montague Land & Irrigation Company down past Granada. The farmers will drill wells and install electric pumps. Noel E. Graves is the engineer supervising the power line work. He states that the water level in the ground is high, making a small lift for the pumps and small cost for placing the water on the land.

PORTLAND, ORE.—Preparatory to the establishment of a municipal lighting plant in Portland to furnish light and power for all the city streets, buildings, shops and parks and possibly to enter into the sale of current for commercial purposes, City Commissioner Daly will ask the city council to uphold him in the appointment of an electrical engineer to make a detailed investigation of the cost and feasibility of such a plant on one of two power sites under consideration. Both of the sites belong to the city. Under budget appropriations, the city has about $5000 available for the investigation. It is proposed to engage a competent engineer to make surveys, soundings and an estimate of the cost of plants on both the sites. One site has a capacity under proper development of 10,000 h.p. and the other has a capacity of 30,000 h.p. As the city uses only about 3100 h.p. the plan opens the way for the city to enter into the commercial power field. At present, under a contract with the Portland Railway, Light & Power Company, the city's light and power bill amounts to about $200,000 a year. The contract for the service at this rate extends for 2½ years yet.

TWIN FALLS, IDAHO.—The Public Utilities Commission of this state will hold special meetings at Buhl and Twin Falls during the week commencing May 25th to consider the application of the Clear Lake Power & Development Company for a certificate of convenience and necessity for entering what is known as the greater Twin Falls country with an electric power distributing system in competition with the Great Shoshone & Twin Falls Water Power Company. At the same time a hearing will be given the Great Shoshone & Twin Falls Water Power Company and the Idaho Power & Light Company which have been in controversy for some time over the control of the southern Idaho territory. The city council of Twin Falls at a meeting last week passed a resolution petitioning the public utilities commission to give favorable consideration to the application of the Idaho Power & Light Company and the Clear Lake Power & Development Company for a franchise to enter this territory, the council wishing thereby to throw open the territory to all of the companies wishing to enter the Twin Falls section. The Great Shoshone & Twin Falls Water Power Company as first on the ground, is making a strong fight to hold the territory against other companies.

SALT LAKE CITY, UTAH.—A three cornered contract has been entered into between the state of Utah, the Utah Power & Light Company, and the Utah Light & Railway Company for the transmission of electric power from the state plant in Logan Canyon to all the state institutions. The state built a power plant in Logan Canyon three years ago intending to supply all of the various state institutions from this plant, but up until the present time a satisfactory arrangement for the transmission of this power has not been arrived at. Under the terms of the present contract, the Utah Power & Light Company transmits the power from the state power plant in Logan Canyon to Salt Lake City, Ogden and Provo over its high tension transmission lines. At Salt Lake City and Ogden the current is turned over to the Utah Light & Railway Company who transmit it over its distribution system to the state capitol, building, university, penitentiary, the industrial school and the school for the deaf and blind. At Provo the Utah Power & Light Company transmit it over their secondary distribution to the state mental hospital. The state power plant furnishes in addition to the current consumed by these various institutions, sufficient power to compensate the transmitting companies for the loss in their system, and the state pays to them as compensation for this transmission service at the rate of 1½c per kw.-hr. for all energy delivered. Governor Spry declares that the contract is a highly advantageous one to the state.

TRANSPORTATION.

OGDEN, UTAH.—Authority for the immediate building of the Huntsville line of the Ogden Rapid Transit Company extending from Hermitage through Ogden River Valley, has been given by the board of directors.

OAKLAND, CAL.—With the explanation that the present name is too cumbersome, the San Francisco-Oakland Terminal Railways Company has petitioned the superior court for permission to change its name to the California Railways.

SAN FRANCISCO, CAL.—In line with a statement made by Jesse W. Lilienthal, president of the United Railroads, that he stands ready to consider a proposition from the city authorities looking toward the taking over of the United lines by the city prior to the expiration of the franchises. Mayor Rolph has announced that he is ready to appoint a committee at any time to confer with the company on the matter.

SAN FRANCISCO, CAL.—The board of works has called for bids for electrical conductors for the municipal railway to be opened June 10th. The cost is estimated at $39,000. The bids will cover the furnishing and installation of all overhead trolley wire, underground feeder cables and appurtenances for the Van Ness avenue, Potrero avenue, Chestnut street, Fort Mason, Stockton street, Columbus avenue and California street lines.

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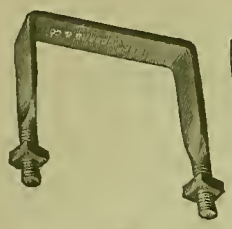
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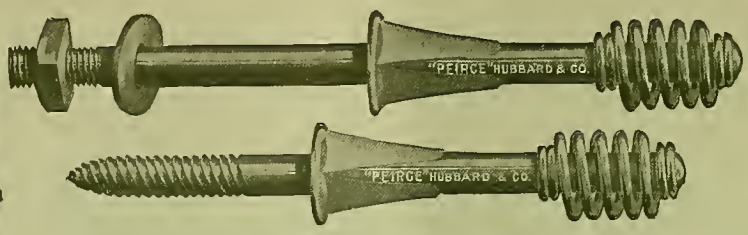
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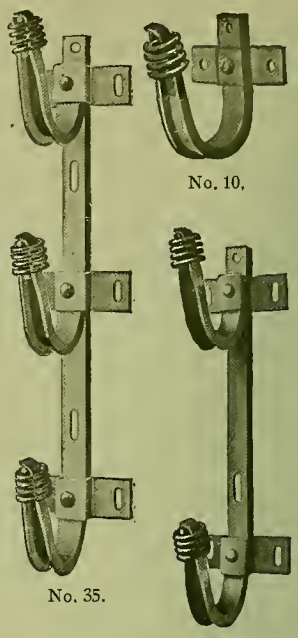
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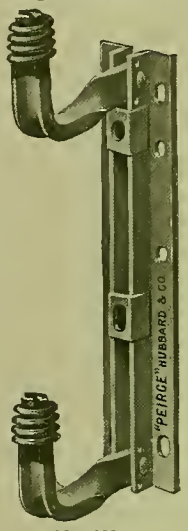


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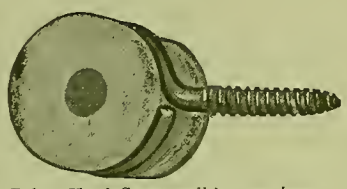


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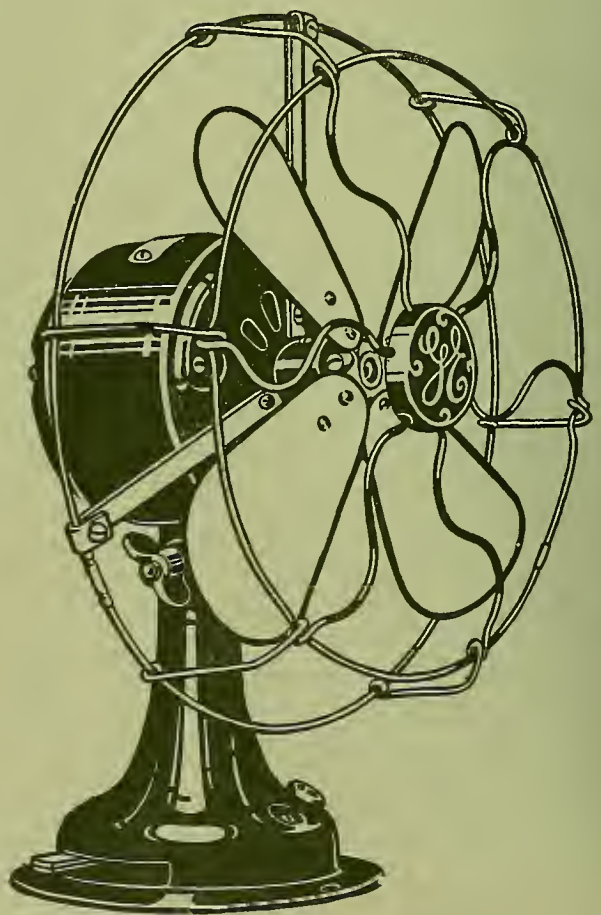


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WATER POWER PLANT ECONOMICS

BY O. B. COLDWELL.

(The author, who is general superintendent Portland Railway, Light & Power Company, discusses this subject out of a wide experience. The variation in hydroelectric power plant practice is appreciated, but it is believed that the many points presented have a direct bearing upon water power plant economics. This paper was presented at the thirty-seventh annual convention of the National Electric Light Association, held at Philadelphia, Pa., last week.—The Editors.)

For a number of years past much time and attention has been devoted to the subject of steam-plant economics. The Prime Movers Committee of the N. E. L. A. has undertaken in its annual reports to cover the subject in its details and numerous papers on various phases of it have been presented to the association. The American Electric Railway Association and other engineering bodies have also been active along the same lines. In fact, it has been the one all-important subject before the operating officials of central stations generally.

The reason for this is quite evident. Of the total cost of manufacture, the operating cost, made up largely of fuel and labor, forms by far the greater part, and as improvements in efficiency of the plant result immediately in the saving of expense for fuel or labor, there has been much incentive for the operator to devote time to this important subject.

Up to the present time most of the hydroelectric developments in this country have been built under rights owned or controlled by the developing company and as a result, after the development has been made, little attention, relatively speaking, is given to the amount of water used in the plant, or in other words, to the amount of energy consumed in turning out its product.

As a general thing, the operating cost in the water power plant forms but a very small percentage of the total cost of production. Due to this fact, the subject of economics in water power plants has not been given as much attention as steam plant economics by the central station operating people. Inasmuch as step-up and step-down transformers and transmission lines are required before energy made in a water power plant is ready to turn over to the distributing system, all of which is ordinarily not necessary in the case of steam generation, it is interesting to note how much difference there actually is in total cost of generation when both steam and water power plants are put on an equal footing. For the sake of comparison, there are shown in Fig. 1 some curves of unit costs of production in cents per kilowatt hour for a combined steam and water power system at various capacity factors. It is thought that these curves bring out clearly the distinction in the foregoing. A brief discussion of them is offered in the following:



River Mill Power Plant and Ambursen Dam—Portland Railway, Light and Power Company.

Abscissae give the value of capacity factor which may be defined as the ratio of the average load in kilowatts during any particular period to the rated plant capacity; it might be called the load factor based on rated capacity.

Ordinates above the zero line give fixed costs in mills per kilowatt hour, which for steam are taken at 12 per cent on $100 per kw. investment, and for water as 11 per cent on $188 per kw., the steam investment figure being the average for the steam plants of the system, the water power investment figure being the average for the water power plants, including trans-

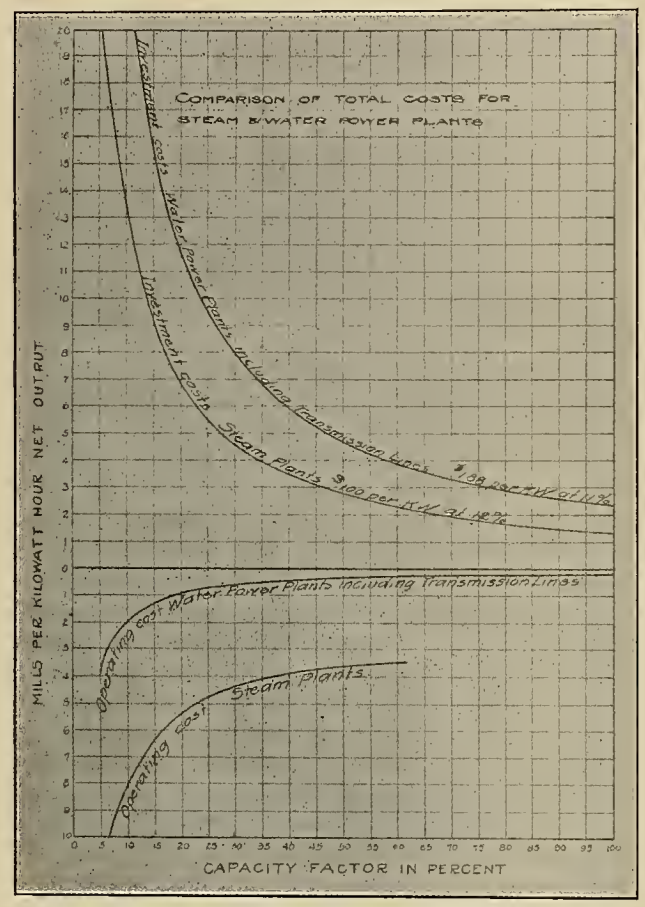


Fig. 1. Steam and Water Power Plant Costs.

mission investment and the cost of step-up and step-down transformers, thus putting the water power plant on a footing equivalent to that of the steam plant.

Ordinates below the zero line give operating costs in mills per kw.-hr, the method employed in plotting making it possible readily to ascertain the total cost in mills per kw.-hr. at any particular capacity factor by adding together the values of the ordinates above and below the zero line.

The water power operating cost curve was derived as a result of investigating the cost of operation of the several water power plants on the system; likewise the steam plant operating cost curve was derived as a result of studying the operating costs of the steam plants on the system, the fuel in use being sawmill refuse at the rate of one dollar per unit of 200 cu. ft.

It is appreciated that the subject of hydraulic-plant economics, like that of steam plant economics, is a complex one, possible of endless variety and that there are many phases of it which in themselves could readily form the topic for a paper. The object in mind in this paper is to submit for your consideration a general discussion of the elements entering into the design, construction and operation of hydraulic plants which have to do with economy.

Stream and Watershed.

Few, if any, of our water power streams have flow characteristics such as will give a steady plant output the year through. If there is any choice in the matter, it is generally preferable, other things being equal, to select a stream with a low ratio of flood discharge to minimum flow. The possibility of storage reservoirs has a decided bearing on the matter, however, and before the plant site is selected there should be at hand, if possible, reliable flow data over a period of years. Government statistics are often available and may sometimes be used with a considerable degree of confidence.

The minimum and maximum flow and the duration of the periods in which extreme conditions exist are important factors in the determination of the type and character of plant construction as well as the size and number of units ultimately to be installed. Inasmuch as the majority of streams have sufficient water throughout the greater part of the year to carry loads heavier than can be handled by the minimum flow of the stream it becomes economically possible to install apparatus in the power house of a rated capacity in excess of the low flow capacity of the stream. The determination of the extent to which this may be done is one of the interesting problems of hydroelectric developments. A stream on which the ratio of minimum to maximum flow is 1:3 could not economically support a plant overdeveloped to the same extent as a plant on a stream where this ratio is 1:50. The ratio between the plant rating and the possible output of the stream at its minimum stage is here termed the degree of over development and for its determination requires an economical study of present and prospective loads on the plant and on possible steam relay plants, load factor, water storage, both seasonal and daily, and the manipulation of storage in connection with auxiliary steam plants or other hydraulic plants on the same stream.

The value of seasonal storage of water is generally realized both as applied to electric power generating stations and to irrigation projects. It frequently happens that a comparatively small expenditure for a storage dam at the head waters of a stream yields desirable returns in stream flow control. In some cases the problem resolves itself into making a selection between an auxiliary steam plant and a storage project, taking account of the operating and maintenance charges of the one against the investment charges of the other.

The limitations of the energy producing ability of the water power plant are nearly always dependent upon the engineering studies made at the outset and too much stress cannot be laid on the bearing which the selection of a site has upon the ultimate economic operation of the plant. In the proceedings of the American Institute of Electrical Engineers for March, 1914, appears a paper by Cary T. Hutchinson on "Economical Capacity of a Combined Hydroelectric and Steam Power Plant." This paper is a very important contribution to the subject of hydraulic plant economics. The

author develops an interesting analytical method of treating the subject and after deriving a number of formulae, illustrates their application by means of certain numerical examples. It is recommended that this paper be given careful study by all students of this subject.

Various Types of Hydroelectric Plants.

The type of plant has a direct bearing on the economical use of water. Each and every project necessarily has its individual characteristics, but in general the following types may be taken as representative:

Diversion dam with open canal or flume to forebay pond.

Diversion dam with closed or pressure conduit.

Dam creating pondage erected at a point of utilization of water requiring short water passages to units.

Variable head projects where special designs are required because of high back water.

In addition to the study of construction costs, the selection of the type of plant to be adopted should also include a careful study of stream hydrographs, duration curves and load data. In many cases, there is no selection to be made as the circumstances dictate one particular type of development. It often happens, however, that it becomes the duty of the engineer to make a selection between a low diversion dam with long conduit, and a high dam at the point of application, which creates a large reservoir immediately back of the power house. In making a comparison of the relative merits of the two types of plant due consideration should be given to the permanency or life of the various structures as necessarily affecting depreciation charges, repairs and reconstruction. The effect of the load-factor of the load which it is proposed to carry on the plant under consideration is important. If the plans provide for only a small forebay supplied by a canal or flume, the water carrying capacity of the canal or flume available for energy output must be sufficient to care for the peak load. If a large forebay pond is provided the canal or flume capacity need only be such as to supply the average load requirements.

It is readily appreciated that a plant not equipped with terminal reservoir facilities has marked limitations when it comes to carrying loads of a variable character. Such a plant is at its best when the load factor approximates unity and of necessity is wasteful of water when the load drops below normal.

Headworks and Intakes.

Under this heading come the various types of dams and their appurtenances. It is altogether beyond the scope of this paper to undertake the discussion of the many features entering into the selection of headworks and intakes. Suffice it to say that a tight dam which does not leak water is essential, both from the standpoint of safety and the saving of water. Among the satisfactory types of dams in general use are:

Timber crib, rock filled dams, usually under 50 ft. in height.

Solid concrete or gravity dams.

Masonry dams.

Hollow concrete, cellular or Ambursen dams.

Earth dams with core walls.

In some instances dams have been successfully built on foundations which are not very promising so far as tightness is concerned. Many ingenious schemes have been tried to render such foundations impervious to water. Probably the most successful plan yet tried is that of forcing cement grout under air pressure into core holes drilled into the material, from which the grout finds its way into the crevices and voids, tending to render the same impervious to water. An interesting paper describing work of this character carried out on the foundations of a dam for hydroelectric purposes will be found in the January, 1914, Proceedings of the American Society of Civil Engineers, by H. A. Rands.

Intakes of many types are employed. An essential feature of the intake having a bearing on the economic use of water is the design of the trash racks. These racks should be constructed to give sufficient area for



A Wood-Stave Siphon.

water passage in order that there may be no excessive loss in head. In low head developments where large quantities of water are utilized this is an important matter. Considerable loss in efficiency may result from restricted water passages through the racks. In the design, allowance should be made for the accumulation of trash as a factor in the restriction of water passage.

The design of control gates for water intakes has received a great deal of attention and is an important factor in the economical and safe operation of hydraulic plants. The use of balanced gates and gates on rollers is finding considerable application and offers some advantages. A type of hand operated timber gate mounted on rollers which is self-closing under full head, gives satsfactory results. A type of intake which

avoids heavy gate operating mechanism and allows of simple gates consists of a tower located in the forebay or reservoir, with openings and gates at various elevations provided with the main outlet in the bottom of the tower. This is especially applicable to the control of water level in storage reservoirs.

The use of fender booms properly designed and placed will effect a saving in operating expenses by diverting trash over the spillway.

The use of splash boards on the spillways of dams as a means of increasing the effective head during low water periods has been pretty generally adopted and in many instances automatic control of splash boards has been employed.



Gasoline Car on Trail Laid Along Top of Flume.

The design of the spillway of the dam is of economic importance, inasmuch as improper designs are apt to bring about undesirable erosion resulting in expensive maintenance. In many instances log chutes must be taken into account when designing the dam and care should be exercised to see that these are so constructed that there will not be excessive loss of water.

In the case of a development of the low dam type with canal or flume, the territory over which the structures extend is often considerable and convenient means of getting over the ground rapidly is of importance. In many instances gasoline cars operating on tracks erected on top of the flume or alongside of the canal line have been used, thereby effecting a considerable economy in operation. Such a car line is illustrated. Likewise telephonic communication between the headworks plant with telephones at intervals along the conduit save a great deal of time.

Types of Conduits.

As in the case of dams, there is a great variety of types of conduits. Excavated canals without lining have been used extensively in the case of high head development, these sometimes running for miles through the mountains. Wood and concrete lined canals are also in general use. There are several types of flume construction in common use. These are usually of the wooden box type built on a bench along the hillsides or on timber bents. Reinforced concrete flumes of various sections have also been employed to a limited extent. In the case of closed conduits, wooden stave pipe has found extensive application and is generally considered very satisfactory where used. Steel pipe, reinforced concrete pipe, timber, concrete and rock lined tunnels are all employed. The selection of the particular type of conduit construction is an engineering problem of considerable importance and has to do with the economic operating features of the plant. The object in mind should be that of keeping down to a minimum the losses in the conduit. A very important feature is the matter of transition from one shape of conduit into another. Unless proper design is obtained at these points, the loss of head is apt to be increased. In the case of wooden box flumes, the construction on bents with side braces has advantages over the bench type of construction, due to easier replacement of timbers in making repairs. Success is being attained in repairing a box flume of the bench type of construction by replacing the timber sills and posts with reinforced concrete, the concrete members being installed at points midway between two adjacent sets of the present sills and posts. Air pressure is used to inject the concrete into place. It is expected that the life of the flume planks will be prolonged several years by using this method and when the time arrives for replacing them, it will be a relatively easy matter to do so. Fig. 2 shows the design employed.

It goes without saying, that a flume or canal line should be maintained so as to free from any considerable amount of leakage. Gates are sometimes installed in flumes to prevent the water in the forebay flowing backward in the event of a break in the flume. If installed, these should be automatic in operation. An interesting application of a gate in a flume is a drop gate which is electrically operated and designed to open and empty the flume in case of a break at any point below the gate where the outflow of water would be dangerous to other property.

The coefficient of friction determined from actual conduit gaugings as compared with those calculated by means of the various formulae in use in the design of these conduits is of interest. The following is a tabulation of some results obtained in concrete lined canal and wooden box flume:

Concrete-Lined Canal.

Trapezoidal in section, 13 ft. wide on bottom, sides 1 to 1 slope, vertical depth 6 ft.; grade .1 per cent.

Depth	(As Measured)		(Bazin $m = 0.22$)		(Kutter $n = 0.014$)	
feet.	vel.	cfs.	vel.	cfs.	vel.	cfs.
1.2	3.01	51	3.65	62	3.48	59
2.1	4.81	152	4.93	156	4.80	152
3.0	5.74	276	5.88	282	5.80	279
4.2	6.90	499	6.88	497	6.86	496

Wooden Flume.

6 ft. 10 in. deep, 9 ft. 6 in. wide; grade .2 per cent.

Depth	(As Measured)		(Bazin $m = 0.06$)		(Kutter $n = 0.012$)	
feet.	vel.	cfs.	vel.	cfs.	vel.	cfs.
1.0	4.57	45	5.71	54	5.02	48
2.0	6.81	131	7.67	148	7.17	136
3.0	8.05	229	8.84	252	8.52	243
4.0	9.41	358	9.67	367	9.46	369
5.0	10.20	485	10.28	489	10.21	485

Penstocks.

In the construction of penstocks choice may be made of different kinds of materials except in the case of high head plants, where steel is almost invariably used. The determination of the number and size of penstocks, the number of units per penstock, etc., is an important part of hydraulic plant design and has its effect upon operating efficiency. An important consideration in the design of the penstock is that of the en-

trance to same. A bell mouth or tapered entrance will often obviate a loss in head which may be considerable.

Often very good results have been obtained by securing from the water wheel manufacturer recommendations concerning the size of penstocks to be used. In a paper read by the writer before the Pacific Coast Convention of the American Institute of Electrical Engineers in April, 1912, it is recommended that the

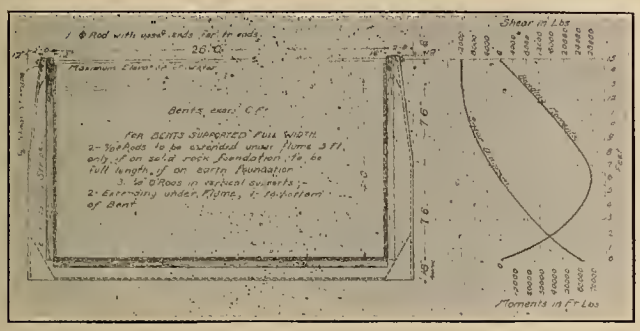


Fig. 2. Concrete Posts and Sills—Wooden Flume Box.

purchaser and the manufacturer co-operate in the matter of securing the very best design and to that end there is set forth a list of data to be given to the water wheel manufacturer by the purchaser and likewise a list of the data to be supplied to the purchaser by the water wheel manufacturer. Inasmuch as all this has a direct bearing on the economic use of water in the plant, it is thought well to repeat the lists here. They are as follows:

Data to Be Given to Water Wheel Manufacturer.

1. Number of units.
2. Horsepower of water wheels.
3. Kilowatts of generator.
4. Total head.
5. Open flume or closed flume.
6. If closed flume, what is number of pipes.
7. What kind of pipe—wooden stave, steel or concrete.
8. Diameter of pipes.
9. Effective head (unless design of all water passages to and iron wheel is left to water wheel manufacturer.)
10. Head water elevation.
11. Floor elevation.
12. Tail water elevation.
13. Head variable, if so, what is normal operating head.
14. If head is variable, what is the range of variation.
15. How important is power and economy at lowest head.
16. Speed of generator, if already decided.
17. If speed of generator is not decided, name speeds which seem to purchaser most desirable and ask recommendations.
18. Flywheel effect of generator.
19. What speed regulation is desired for different load changes.
20. Will units run in parallel with other plants? If so, give general characteristics of such plants.
21. If running in parallel with other plants, can these plants be used to regulate the system?
22. What is the character of load factor?
23. What is the nature of water (silty or clear).
24. What date shipment of material is desired.
25. Advise if it is expected that manufacturer shall furnish governor.
26. Give sketches of power plant site.
27. Give information as to what is to be expected in the way of guarantees.
28. Give any other information which you think would influence the design of the wheel.

Data to Be Supplied to Purchaser by Water Wheel Manufacturer.

1. A check of the calculation on effective head.
2. Horse power guarantee at normal head.
3. Guarantee at other heads, if head is variable.
4. Speed guarantee, including runaway speed.
5. Recommendation for best speed if same has not been determined.
6. Speed regulation guarantees.
7. Efficiency guarantees at full load, ¾ load and ½ load.
8. Point of greatest efficiency of wheel and value of same in per cent.
9. Efficiency guarantees for available head conditions.
10. If water wheel manufacturer furnishes governor, give information as to the type, make, power required to operate same, also what variation in speed will not be exceeded before the governor will begin to readjust gates to meet a change of load, either gradual or sudden.

    In what time will governor completely open or close gates?

    Within how many seconds will the speed of the unit be restored to normal?
11. Complete drawings showing machinery proposed.
12. Complete description of machinery proposed.
13. Guarantee of durability.
14. Guarantee of shipment.

Pondage.

In general there are two kinds of water storage which may be considered: seasonal and daily. In the case of a stream where the ratio of the maximum flood to the minimum flow is high, seasonal storage of water will be of very great advantage. Investigation of the watershed may disclose suitable location for cheap storage dams where large quantities of water may be impounded and drawn upon during the dry season. Such storage, when it can be secured, plays an important part in the operating economies of the water power plant or plants on the stream below as it virtually results in an increased minimum flow of the stream and more plant output. In one case which has come to the attention of the writer it has been shown that a timber storage dam 60 ft. high would enable sufficient water to be impounded so that by drawing down the pondage during the dry season the minimum flow of the stream could be increased 25 to 30 per cent.

Sufficient forebay pondage, if it is possessed by a water power plant, gives the opportunity of readily taking care of the daily fluctuations of the load and more economically using the water. The ordinary load curve imposed on electric systems has pronounced valleys and peaks and during the dry period of the year such forebay pondage assists the operator to get all there is out of the water and keep down the reserve steam plant operation to a minimum. In most large electric systems provided with a combination of water and steam plants, a very careful study is made of the amounts of pondage available, and operating programs are worked out so that the load dispatcher can get the best results with what he has to work with.

It does not necessarily follow, however, that water power plants without forebay pondage are inefficient. If such plants are operated on a system in conjunction with other water power plants with forebay pondage, the latter plants can handle the fluctuations and allow the plant without pondage to operate on the base of the load curve. This matter of water storage and

manipulation of stream flow is probably the most important factor having to do with water power plant economics. In many instances it is impossible, due to physical conditions, to secure the advantage of water storage, but wherever it can be obtained the resulting economies are large.

Main Units and Auxiliaries.

For economical operation the units in the plant should be properly selected. This is a matter which could not be taken up in this paper. Reference is again made to the A. I. E. E. paper by the writer on "Selection of a Water Wheel Unit," of April 20, 1912. (Published in this Journal on April 20, 1912.)

The amount of load on a plant dictates, to a certain degree, the number of units which should be in operation at any particular moment in order to bring about the most economical use of water by the water wheels, but this consideration is often modified, due to the desirability of having ample capacity connected to the system to meet any emergency that may arise.

There are numerous features and devices which have been found to have an important bearing on economical and efficient operation. In this connection, there might be mentioned:

Head and tail water level indicators used for the purpose of ascertaining the total head on the plant. Within the last few months there has come to the attention of the writer an electrical water level indicator of interesting design, the invention of D. W. Proebstel. In discussing the application of such a device and its importance to hydroelectric plant economics. Mr. Proebstel says:

> A water turbine will give the most efficient operation when running under normal capacity at approximately the head for which it was designed. This head should be maintained as nearly constant as possible. If the demand for water exceeds the supply, the head will drop. On the other hand, the head will rise and perhaps useful water will be lost over the spillway if the supply exceeds the demand. Either condition represents an uneconomical period in the operation of the system. It is desirable then that the operator of a hydroelectric plant should know at all times the exact stage of the water in the forebay. The operator can have this knowledge only through the use of some reliable automatic water stage indicator.

Water flow measuring devices such as Pitot tubes, meters and Venturi meters employed for the purpose of ascertaining the quantity of water used by the wheels;

Recently a number of continuous recording, and indicating flow devices have been used with considerable success. This year's annual report of the Water Power Sub-committee of the Prime Movers Committee deals with such devices in detail and no attempt to do more than mention the matter is made here.

Hydraulic and motor operated valves which are of importance from the standpoint of convenience and safety;

Water cooling systems on the bearings of both generators and water wheels which are often used to insure satisfactory and economic operation;

A reserve pressure pump for the oil system of the governors is often installed and may be of special benefit in insuring continuity of operation;

Overspeed safety devices are coming into common use. These consist ordinarily of a flyball mechanism driven from the shaft of the unit which in the event of excessive speed, by means of control valves admits water behind the piston in an auxiliary cylinder on the governor, causing it to move in such a manner as to overcome the oil pressure in the control element of the governor and shut down the unit. Other types of devices are also in use for the same purpose.

In addition to the foregoing, other features might be mentioned, varying considerably with the characteristics of the particular plant.

Whenever water is carried to the turbine in a long penstock, a large amount of energy is stored in the moving column of water. On account of load variations, there is a change in velocity of water in the penstock resulting in a change in the amount of its kinetic energy, thus producing pressure variations. The magnitude of these variations is dependent upon the velocity of water in the pipe, amount of load change and also upon allowable time for making such change in order to secure proper regulation. If the governor movement required for proper regulation is too rapid the turbine may be made deficient in energy supply when increased load is imposed upon the wheel, or on the other hand, excessive pressure may be caused when load is decreased, thus producing shocks which may seriously affect regulation, or prove injurious to the pipe line or to the turbine wheels themselves.

Owing to the high cost of long steel penstocks, there is a tendency to decrease the size of same, which naturally results in high velocities. In a development where economy in the use of water is desirable, the size of the pipe line is a very important matter. In determining the size of the pipe, there should be taken into consideration the decrease in friction head obtained by using large pipe, the relative cost of a large compared with small pipe, and the cost of auxiliary means for regulating the pressure variations.

In many instances, where the pipe line is of considerable length, it is impracticable to take care of the pressure variations in the design of the pipe line itself. This is especially true in installations where there are large and sudden load changes. The exact conditions of operation should be known and one or more of the following commonly used means should be resorted to, namely: stand pipe or equalizing reservoirs, synchronous pressure regulators or deflecting nozzles in the case of an impulse type of wheel.

Wherever permissible, the stand pipe or equalizer reservoir method is the most satisfactory, inasmuch as it not only absorbs the pressure increase due to load throw off but also acts as a storage of energy when a sudden increase of load is desired. The standpipe should be arranged as close as possible to the wheel itself, thus preventing a long pipe between the standpipe and waterwheel. The practicability of the use of a stand pipe should be determined by considering to what degree the advantages obtained by the saving of water are offset by the cost of carrying the required investment. Wherever possible to use a stand pipe on account of cost or other conditions, a synchronous pressure regulator may be used. This pressure regulator, when the turbine gates are suddenly closed, opens by the mechanical connection to the governor, thus bypassing a portion of the water. The regulator then automatically closes at a speed which avoids shock on the pipe line. Although calcula-

tions show that pressure drop due to sudden increase of load is less than the pressure rise due to an equivalent decrease in load, pressure regulation such as outlined in the foregoing does not take care of pressure drop and it, therefore, becomes necessary to provide means in the form of flywheel effect for taking care of the drop of the pressure to secure proper regulation. This flywheel effect can be secured in the revolving part of the unit or by adding an independent flywheel as may prove most advantageous. It is readily seen that by using pressure regulation there is a wasting of water. The loss due to this is dependent upon the frequency of sudden and large load changes. The deflecting nozzle is used only on the impulse type of water wheel, and so arranged that the water is deflected from the runner blades.

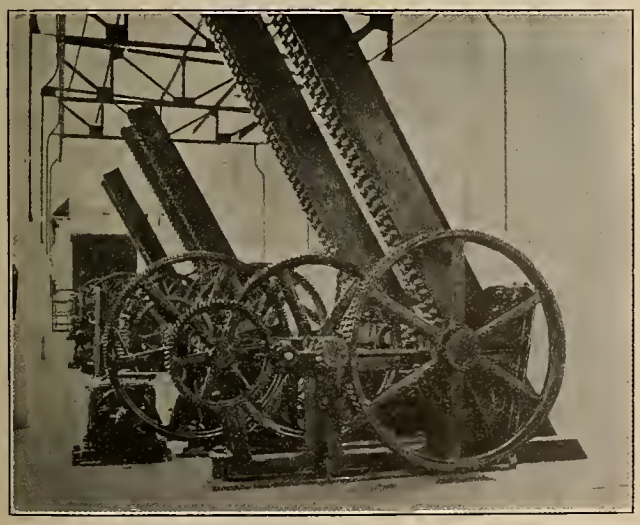
Draft Tubes and Tail Races.

When the water leaves the turbine runners and proceeds through the draft chest into the draft tube, it ordinarily has a considerable velocity head which should be gradually converted into pressure head by so shaping the draft passages that the velocity is uniformly decreased to a minimum. It is readily appreciated that the above would only be accomplished by eliminating any sudden changes in the direction of the water.

The plant should be so located with respect to the tail race that full advantage is taken of whatever draft effect there may be available. In general, tail race should consist of as unrestricted a water passage as conditions will permit.

Electrical Control.

In designing a hydroelectric plant, care should be given to the subject of electrical control. If possible, the switchboard should be, for the sake of convenient



Electrically Operated Headgates.

operation, compactly arranged. In most cases the switchboard is located in full view of the plant and readily accessible to the various parts of it. All remote controlled motors and solenoids on auxiliary apparatus should preferably be possible of operation from a point adjacent to the switchboard. A plant so designed will be more economical to operate than a plant in which the control devices are installed at various points, because the operator can accomplish more at the time when his services are most required.

Electrically operated headgates are used extensively, resulting in a saving of labor and acting as a protection to the plant in case of trouble. All modern plants are equipped with remote controlled governors, so that the speed may be varied by the switchboard operator for purposes of synchronizing and as a means of load adjustment when the machine is operating on the system. Remote electrical control in case of field rheostats enables the rheostat to be located near the generator and results in a saving in the field wiring.

Conclusion.

In the foregoing the writer has touched upon only those matters which his experience in water power plant work indicates are of importance to this subject. He appreciates that hydroelectric plant practice varies considerably and that the experience of others may differ somewhat in the details, but he believes that many of the points brought out will be recognized as having a direct bearing on the economic principles of hydroelectric plant practice.

It is deemed proper at this point to make a plea for a more general use of such plant records as will enable the regular plant force to know and understand the methods used in arriving at the efficiency, to the end that they may be encouraged to maintain a high all-day operating efficiency.

It is further believed that there should be a more general knowledge of how much of the theoretical energy of the stream is obtained at the switchboard and how much each per cent of plant efficiency is worth in dollars and cents.

In an appendix to this paper there is given a copy of a letter on hydroelectric plant efficiency by an engineer connected with a prominent firm of consulting engineers. It is thought that this letter will interest many as it sets forth a number of subjects which it is suggested might be treated in a paper on the subject of hydroelectric power plant economics.

This paper is of necessity a very general treatment of the subject, but it is offered with the hope that it may assist in bringing about a more general interest in the economical features of water power plant work and provoke a beneficial discussion.

Appendix.

Philadelphia, February 24, 1914.

Mr. O. B. Coldwell, General Superintendent Portland Railway, Light & Power Company, Portland, Oregon.

Dear Sir: The subject which you suggest is indeed an extremely interesting one to me and I believe a paper might be written which should prove of considerable value to the members of the N. E. L. A. in assisting them to better understand the many and varying factors entering into the proper design of a hydroelectric plant and to assist them in maintaining the operating efficiency at the highest possible point. The time is coming I believe when records of water wasted on the spillway will be of great value and actual operating plant efficiencies under normal conditions will be of great use to the owners.

I have not had much time to give the subject serious consideration, but in general I might suggest that your paper include a treatment of some of the following subjects, if it is aimed to serve the purpose outlined above:

(1) Plant location with respect to other plants surrounding conditions, possibilities of extensions, etc.

(2) A relative location of power house and dam and the effect of this factor on net head developed, water wasted and ice conditions.

(3) Spillway, length and depth of maximum floods with effect on working head during flood conditions and provisions for possibly delay or seasonal pond storage.

(4) Racks and intake devices covering such details as removable sections, tapered bars, heating of rack bars, trash sluices, length and angle of racks and width of working space.

(5) Head gates: Comparative merits of single and multiple gates, bronze and iron bearing strips, lubricating devices for overcoming initial friction, operating devices for opening and closing gates under extreme conditions with empty penstocks, air inlet pipes and protection of openings from ice, remote and emergency control of hoists.

(6) Filling gates, direct or indirect connection, their relative advantages as between such filling gates are are installed at Cazadero and River Mill.

(7) Penstocks: Relative shapes and dimensions with respect to cost of construction and friction losses, provision for draining and cleaning, etc. Also provisions for measuring flow and protection from extreme cold and where necessary expansion joints for protection against varying temperatures.

(8) Turbines: The advantages versus convenience of underground intakes, efficiencies of scroll casings as against ordinary cylindrical steel casings. The first cost as against maintenance of outside gate mechanism. The wearing of runners and wearing of thrusts, wear on runners and leakage between runners and casings and tightness of turbine gates as against tightness of head gates in reducing to a minimum the no-load leakages. The direction and velocity of draft tube discharge and provision for unwatering the draft tubes for emergency repairs.

The above subjects have suggested themselves in connection with the design of such plants, but any plant when constructed will bear considerable study if it is desired to produce the greatest operating efficiency, and I think it oftentimes proves of some advantage to have the operating force understand the methods of determining the efficiency, and perhaps have some incentive for them to keep the all-day operating efficiency at the highest possible point.

Unlike a steam plant, in the water power plant after once installed, relatively little attention is paid to the amount of energy used in producing its product. In some of our plants we have had occasion to work out charts for the operating force in order that they might be able to have a definite record of the plant efficiency and know reasonably well the total flow of the stream.

It always proves of interest to calculate the actual value of each per cent in increased plant efficiency when the total cost and fixed charges in operating the plant are considered on this basis. It often seems as though it would be well worth while to spend a considerable amount in order to have the most efficient machinery.

You probably have considered the possibility of installing Venturi meters in penstocks or Pitot tubes in the penstocks in such a way as to give a continuous record of rate of use, which, combined with station output curve, would be of considerable value in showing the best points at which to run machinery if it is of any advantage to save water and store it in the pond for peak load use.

The all-the-year-round efficiency is, of course, dependent more or less upon the interruption by accident and the reliability of operation of the plant, and therefore becomes a subject to be considered under the head of efficiency. Many things may be considered as affecting the safety or reliability of operation, and perhaps this might also serve as a subject for discussion in another paper.

If these few suggestions are of interest to you and you think a fuller development might be of some use, I shall be glad to do what I can to assist you further in the matter.

Very truly yours,

(Signed) HERRMANN V. SCHREIBER,
Managing Engineer, Sellers & Rippey.

ELECTRICAL MERCHANDISING BY MODERN METHODS.

BY THOS. E. COLLINS.
(Concluded.)

Importance of Advertising.

The next part of my subject is a most important one—it is the matter of advertising. The topic is too big for me to tackle in this article; books are in the library at your pleasure covering the many points of this subject; magazines are issued regularly devoted exclusively to this work.

I am not directing these remarks to the little dealer up in the country, but right to you gentlemen of this league. How many of you men have gone over to the library and secured a book on the subject of advertising?

Does it pay? Of course it does; we all know it. Then, why haven't you looked into it—you are looking for things that pay; then get into it, and the sooner the better.

By the way of digression a moment—I just looked over a copy of a current popular magazine and found 140 pages of reading matter and 184 pages devoted to advertisements. I don't expect you to be one of them, but I think the example of the national advertiser is well worthy of emulation in local media.

An Advertising Analogy.

The manufacturers of electrical apparatus are national advertisers and it is up to you to co-operate with them. Our national work is like a great long distance transmission system—the jobber connects up with his distribution system and the dealer connects up with the customer with his secondary leads. Each should take his place and do his share, but, unfortunately, we all do not co-operate as we should. I frequently find a dealer who refuses to connect up—he doesn't want to mention the name of the manufacturer.

Let me say a word or two for his benefit. I will read to you an article I recently wrote for the bulletin issued by my company. This book is published monthly and furnished free to all of our regular customers. The mission of this bulletin is the same as mine here today—to give publicity to successful merchandising methods for the benefit of the electrical dealer. We are trying to co-operate with him and do something to advance the industry as a whole:

Mr. Dealer:—Surely you are not one of the few who purposely fail to mention the name of your manufacturer in your daily space in the home town paper. Of course, if you have elected yourself to a seat among the select few who are to sit in solitude and contemplate why trade never even hesitates in front of some people's doors, then I do not desire to say anything that would cause trade fondly to linger, but I assure you, if you are really interested in "more business" that it is much more satisfactory, and, incidentally, profitable to get aboard the band-wagon and contribute your share to the music that draws the crowd.

You say you are not in business to boost the name of the manufacturer. Bless you, no, the name usually needs no boosting, it is too well and favorably known in every hamlet in this broad land—and we intend to keep it so. It is a name that stands for something. Among other things, it is a guarantee of excellence, and that the vast resources of the company—engineering, commercial and financial—stand behind the article bearing this name.

Don't think for a moment that the housekeeper or merchant in your town doesn't recognize these facts—consciously

or otherwise—when they are offered articles bearing this name. You say you do not quite agree with me. All right, Mr. Dealer, I am going to try a little experiment on you with your kind permission and demonstrate to you that the people of your town are just like you and me—just ordinary mortals exercising the same kind of "horse-sense" when they make their purchases.

Let us suppose that you and I went on a shopping tour today, and now that we have patronized all the principal merchants in town, let us summarize:

I want to know why you paid that clerk more money for a Disston saw and why you walked on extra block for a Yale lock? Why did you think Jap-a-lac was better than Chink-a-lac? When the hatter said "Here's a Stetson and here's a genuine Jones," why did you pay more for the Stetson. At lunch time, why did you ask for "Lea & Perrins," instead of plain "Worcestershire Sauce," and why did one of the "57 Varieties" taste better than the other kind? Why did you prefer "Welch's" grape juice to the others?

I could take you over the line of talcum powders, shaving soaps, chewing gums, etc., but I think by this time you are wondering what kind of an answer you are going to put into my questions. Now be careful, for your answer is just my argument in a nutshell. If it was quality that influenced your purchases. you will grant that it was because the quality was considered standard everywhere.

It wasn't price that influenced you, for the brands above mentioned cost more initially than the other kinds. It must be then that these goods were "better known" and that's why you purchased them. Correct—lets go to the head of the class.

Since familiarity with names influenced your purchases, as it does with all of us, then I have demonstrated the little experiment I mentioned in the beginning. I have proved that the people of your town and every town exercise the same "horse sense" as you do.

Now then, in view of these facts, you can no longer refuse to co-operate with us. You say you will think it over—all right, but while you are thinking it over, don't forget the time has come for you to be a real merchant. In the future you must do business along the same lines as the other members of the Merchants' Association—they do not hide their candles under bushels—they are proud to mention the name of their manufacturer. The jeweler isn't ashamed of his line of Elgins, Walthams or the humble Ingersoll. The clothier enhances his standing by gold-lettering his windows, "The Home of Hart, Schaffner & Marx Clothing." The grocer enamels his front with "Lipton's Tea," and so it goes down the line of successful business men.

There is a demand in your town for ———— goods—are you willing to supply it? Surely—then speak right out in meeting and say that you are the distributor of ———— electric ware or that you are a ———— motor dealer. It will give your inquirers the same sense of pleasure and feeling of intimate acquaintanceship that you experience in purchasing standard articles.

Let the little circle of Omar Khayams continue to contemplate in silence and solicitude, but as for you—climb right up here alongside of us, sonny, and co-operate.

Select and Use Manufacturers' Advertising.

All the manufacturers are willing to furnish you with advertising pamphlets covering every electrical subject, you need not dwell in ignorance on any electrical article. Get the literature; place it in a pile; don't get a raft of one kind and let it kick around your store, but select a small assortment with care.

If you advertise in the newspapers, select your copy with care. The manufacturer will furnish you with ad books whereby your copy is already prepared by expert advertising designers—the words and phrases well and suitably chosen; the size and kind of type designated and a cut to go with it.

Now, then, a word on the proper handling of the advertising matter furnished by the manufacturer.

To illustrate my point, I will cite the facts of a recent case. I received word from our publicity department that we would furnish all dealers with a life-sized cardboard figure of a girl to be used for window display in connection with irons and other heating devices. These figures would cost our office $1 each. I was about to order a few hundred of them, but it happened while I was strolling about the city looking over some dealers' windows, I saw a similar article, issued by another manufacturer, on display in the windows of two different dealers. The manufacturer had been generous with his figure and omitted to print his name on the figure. All he did was to print an American Beauty Rose on the lady which I recognized as the trade mark of a well known electric iron, but the figure was not demonstrating that iron—on the contrary it was handling another iron of well-known make.

Gentlemen, that is not a square deal; that figure cost the manufacturer $1 to buy in large quantities, to say nothing of his time, trouble and consideration in furnishing to the dealer this article free. I found two situations of this kind in San Francisco, and both were the largest and most responsible stores in our city. Treatment of this kind shows lack of courtesy and consideration, and breaks the confidence of the manufacturer, which in turn reacts upon you.

On the general subject of advertising, I must say it is like fishing—some fellows get a fine basket-full; some baskets are empty; some catch the rare trout by skillful angling and alluring bait, while others catch suckers. It all depends upon the kind of fish you are looking for and how you handle your rod, and the kind of bait you are using.

High Percentage of Women Buyers.

Let me conclude by telling you that 75 per cent of the American buyers are women. I don't mean to say that 75 per cent of your purchases are made by women, but covering all kinds of purchases, that 75 per cent of the buyers are women. It would be well for you to note the percentage of electrical buyers and I am sure you will find that your patrons number very nearly this percentage and this is a factor we frequently ignore. Therefore, it is up to you to present your wares, your advertising and your salesmanship in a manner to please and attract the feminine mind.

Don't advertise your wares from your standpoint, using technical terms, but from their standpoint, using a refined, pretty illustration and some light airy talk on the merit and beauty of the article.

This feminine factor is one we must always reckon with even in the electrical business, and with a little reflection, you will recall the dominating influence which selected the fixtures, the iron, the fan, the coffee percolator and what not. Display your goods to please the feminine mind and you will be surprised at the results.

(The Society for Electrical Development, Inc., has organized a display service bureau for the purpose of assisting its members in all matters pertaining to the sale of electrical equipment and the photos used in illustrating this article were supplied by the service.—The Editors.)

PHILADELPHIA CONVENTION N. E. L. A.

The close of the thirty-seventh annual convention of the National Electric Light Association has left the industry enriched by the several valuable reports and papers presented. In the worth of these contributions and in fact in all details, this convention held at Philadelphia, Pa., from June 1-5, sets a still higher mark for future convention committees to equal or attain.

The news item of greatest importance to the Pacific Coast was the decision to hold the 38th convention at San Francisco in 1915 in connection with which one of the most important gatherings of the association is anticipated.

Holton H. Scott, manager Doherty Operating Company at New York City, was elected president, an honor which in the usual course of events would have fallen to John A. Britton, vice-president of the Pacific Gas and Electric Company, San Francisco. Mr. Britton, due to the burden of his duties as a director of the P. P. I. E. Company and in connection with his other business connections, was, however, reluctantly compelled to refuse the honor.

The programme was probably one-third smaller than for several years past in the number of items and the object of this was to allow more time for complete discussion. This was also accounted for by the large number of committee reports made in place of the individual papers previously presented. In this matter the N. E. L. A. is simply trying to interpret the spirit of the times in the wise utilization of time; in this case the most valuable time of the central station men's year.

The Philadelphia Electric Company acted as hosts for the convention and provided excellent entertainment for the ladies, the delegates and guests.

The program launched on Tuesday, June 2d at 10 a. m. was as follows:

General, Executive and Public Policy Sessions.

Tuesday, June 2, 10 a. m.

(1) Welcome to the city. (2) Address of President McCall. (3) Announcements. (4) Report of committtee on organization of the industry, by Holton H. Scott. (5) Report of secretary, by T. C. Martin. (6) Report of insurance expert, by W. H. Blood, Jr. (7) Report of committee on progress, by T. C. Martin. (8) Report on the "Question Box," by S. A. Sewall. (9) Paper, "Safety First," by Paul Lupke.

Wednesday, June 3, 8 p. m.

(1) Action on report of public policy committee, presented by Arthur Williams. (2) Presentation of proposed constitutional amendments, by F. W. Frueauff. (3) Report of treasurer, W. F. Wells. (4) Election of nominating committee. (5) Appointment of committee on resolutions.

Wednesday, June 3, 8:45 p. m.

Public Policy Session: (1) Reading of report of public policy committee. (2) Address. (3) Exercises in celebration of the first American Electrical Exhibition and first International Electrical Congress, in Philadelphia, 1884.

Friday, June 5, 10 a. m.

(1) Report of committee on award of Doherty medal. (2) Address, "The Definite Plans of the Society for Electrical Development," by J. M. Wakeman. (3) Symposium, relations with geographical sections. (4) Report of committee on memorials, by T. C. Martin. (5) Report of committee on constitutional amendments, by F. W. Frueauff. (6) Vote on constitutional amendments. (7) Report of committee on resolutions. (8) Report of nominating committee. (9) Election of officers. (10) Adjournment.

Technical Sessions.

Tuesday, June 2, 2:30 p. m.

(1) Report of committee on meters, by P. H. Bartlett. (2) Report of committee on grounding secondaries, by W. H. Blood Jr. (3) Report of committee on international measurements and values, by A. E. Kennelly. (4) Foreword, "The Greater Electric Vehicle Problems," by W. P. Kennedy. (5) Address, "The Electric Vehicle," by C. P. Steinmetz.

International Measurements and Values.

One of the most important international electro-technical decisions in recent years relating to industrial electrical measurements, has been an agreement, through the International Electrotechnical Commission, upon an international standard conductivity for commercial copper. Copper is the metal by far the most extensively used for electrical conductors all over the world. The resistance of copper wires, of given length, cross-section and temperature, is a matter constantly calling for consideration in electrical work. The change of temperature of conductors, overhead, underground, submarine, or in the coils of machinery and apparatus, is perhaps most conveniently and decisively determined by measuring their accompanying change of resistance. Consequently, the laws underlying the variations of resistance are of great technical importance, while an international standard of resistivity and its variation with resistance, is of great practical importance in the electrical industry.

In this report a brief outline is given of the course of events which led to the adoption of an international standard of electrical conductivity for copper, by the International Electrotechnical Commission, in Berlin, last September. The meaning of this international agreement is touched upon, and the English text of the agreement appended, verbatim, for reference.

The Greater Electrical Vehicle Problem.

The prospective enterprise of vehicle exploitation on a large scale needs nothing more urgently than adminstrative effort, exerted cohesively and comprehensively, to place it upon a plane with the major operations of central station activity and thus give to it the impetus necessary to insure the cumulative return certain to endow its projectors. As a business proposition commanding the attention of the captains of the industry conditions could not be more attractive; the grist is on the threshold and the mill has ample power. Evidence of what has been done and can be done is abundant, convincing and conclusive. Under the directive influence of that creative talent which has fabricated our stupendous urban electrical utilities, the facilities of such a powerful machine as the collective centres of energy radiating from the central stations throughout the country could yield a force compelling the almost universal employment of the electric motor wagon in city merchandise transportation and the electric carriage as a domestic convenience and comfort.

We need the superlative administrative genius which has harnessed our natural resources to perform our industrial and community service; that breadth of view which can bridge profit for the brief accelerating period, in anticipation of the fullness of ultimate development; that calibre of judgment which can suppress trivial difficulties and concentrate upon a program of effort against which nothing can prevail. We need the Master Mind at work.

Wednesday, June 3, 10 a. m.

(1) Report of committee on electrical apparatus, by L. L. Elden. (2) Paper, 'Temperature and Its Capacity of Electrical Apparatus," by F. D. Newbury. (3) Report of committee on underground construction, by P. Torchio. (4) Report of committee on overhead line construction, by Thomas Sproule.

Temperature and Its Effect on the Power Capacity of Electrical Apparatus.

This paper presented the information at present available on the heat and temperature conditions within large alternating current generators, the same temperature limits of the various insulating materials commonly used, and the significance of temperature measurements by different methods. The heat and temperature conditions within generators are shown by a number of temperature diagrams for typical heat paths within the generator. Actual temperatures as measured in generators are also given, showing that total temperatures from 100 to 130 deg. at the hottest part of the generator are not uncommon. A safe temperature limit of 105 deg. is given for treated cotton, paper, silk and similar fibrous materials. A temperature limit of 105 to 125 deg. is given for combinations of the above materials with mica or similar heat resisting materials when both classes of materials are depended upon for insulation strength. With combinations of the same materials but in which mica and similar heat resisting materials furnish the entire insulation strength, a limit of 150 deg. is given. Various tests and instances of generator burn-outs are cited to support the temperature limits given. The significance of temperature measurement by mercury thermometer, resistance of windings and by thermo-couples is shown.

Overhead Line Construction.

The Committee on Overhead Line Construction presented as its report a revision of the first two sections of the 1911 report covering primary and secondary line construction. The scope of that portion pertaining to primary line construction has been broadened and both sections have been revised in order to include additional approved methods of construction. The committee's report is printed in full in a handbook on overhead line construction prepared by a sub-committee of the main committee. The handbook contains, in addition to the committee's report, descriptions of the methods and the materials employed in overhead line construction; also the necessary formulae for the electrical and mechanical solutions of various transmission and distribution problems.

Electrical Apparatus.

The report of the committee dealt with the design of the more recent types of generating and converting apparatus, air-cooling devices, switchboard equipment and protective devices necessarily included in complete modern systems of distribution. New methods of switchboard control and the use of synchronous condensers for voltage regulation of high tension transmission lines are of more than passing interest. The design of outdoor and indoor stations, and the elimination of personal and fire hazards in electrical systems should receive attention. Important advances in the development of temperature measuring devices suitable for use in connection with electrical apparatus are described. Standardization work in general is treated at some length in the report.

Underground Construction.

The report of the committee deals with a number of problems treated by members of the committee who have had particular experience in these problems. One of the contributions deals with alternating current underground distribution practice as to junction boxes, fuses, oil switches and other devices for sectionalizing and interconnecting purposes. Another section discusses the question of underground transformers. The omission of emergency relief valves is recommended in all cases. Illustrations of methods of ventilating transformer manholes are given. The third section reviews the practice of joint making for high tension cables and recommends the use of the vacuum for extra high voltage cable joints. Experimental data on protection of cables in manholes by the use of cement covering in comparison with asbestos and steel tape, showing a marked advantage for the cement covering, is given and details of a fruitless effort to discover an inexpensive underground distributing system.

A marked difference is shown in the thickness of insulation used for cables of relatively low voltages, but greater uniformity for high voltage cables. The maximum allowable loading for different companies gives temperatures varying from 90 deg. to 150 deg. F., for the lead sheath; and tests made to supplement this information show that the temperature of the conductor would be as much as 75 deg. F., higher than the sheath. Attention is called to the possibility of varying the maximum loading with the seasons of the year. The cable burn outs for 2300 miles of cable were 14.2 per 100 miles, of which 78 per cent were in cable section and 22 per cent in joints. The report makes reference to the organization of the Joint National Committee on Electrolysis, on which the N. E. L. A. is represented by three members, and advises member companies to co-operate with this National Committee.

Thursday June 4, 2:30 p. m.

(1) Report of committee on prime movers: (a) steam, by I. E. Moultrop; (b) hydraulic, by J. F. Vaughan. (2) Paper, "Selection of Hydraulic Turbines," by Charles V. Seastone. (3) Report of committee on street lighting, by J. W. Lieb. (4) Report of committee on accident prevention, by M. J. Insull.

Prime Movers.

Under the heading of steam power the committee discusses twelve subjects which are of interest at this time, as follows: Cost of Steam Power Stand-By Service; Forced Draft for Peak Work; Emission of Smoke and Cinders from Chimneys; Burning Pulverized Coal; Under-Water Storage of Coal; Fire Brick; Steam Flow Meters; Surface Combustion; Condensers; Boiler Tubes.

Remarks are included on the "Cost of Steam Power Stand-By Service," an article on "Forced Draft for Peak Work," a review on "Foreign Practice and Tendency," which is interesting in that it shows what efforts the engineers of other countries are making to improve their plant efficiency.

In continuing the work of last year on water power the following subjects have been taken up: Water Power Plant Economics; Methods of Measurement of Water in Operation; General Principles Governing the Selection of Water Wheels; Use of Center Bearing Between Runners in Horizontal Double Runner Center Discharge Wheel Settings and Leveling of Shaft; Recent Results with Kingsbury Thrust Bearing; Water Wheel Testing Flume.

Papers have been secured for the convention on the first and third subjects.

A review is also presented of the recent developments in oil engine manufacture and the tendency in price of available fuel oils. A considerable discussion is given of the factors surrounding the use of the heavy oil engine and of various conditions that should be taken into account when considering this type of prime mover. This part of the report is of a general character and is supplemented by tables and illustrations in order to present the status in an instructive manner.

Commercial Sessions.

Tuesday, June 2, 2:30 p. m.

(1) Address of the chairman of the section, by T. I. Jones. (2) Report of finance committee, by E. L. Callahan. (3) Report of membership committee, by J. F. Becker. (4) Report of publications committee, by Douglass Burnett. (5) Report of committee on education, by F. C. Henderschott.

Wednesday, June 3, 10 a. m.

(1) Report of committee on rate research, by E. W. Lloyd. (2) Address. (3) Report of lamp committee, by F. W. Smith.

Thursday, June 4, 10 a. m.

(1) Report of committee on non-peak and high-load-factor business, by G. H. Jones. (2) Address "Age of Co-operation," by Elbert Hubbard. (3) Report of committee on interurban lighting of highways, by G. B. Tripp.

Thursday, June 4, 2:30 p. m.

(1) Report of committee on wiring of existing buildings, by R. S. Hale. (2) Report of committee on electrical merchandising and advertising, by Parker H. Kemble. (3) Report of nomination committee. (4) Election of officers.

Hydroelectric Sessions.

Thursday, June 4, 10 a. m.

(1) Address of chairman of section, by W. W. Freeman. (2) Report of committee on hydro-progress, by T. C. Martin. (5) Paper, "The Nature of Electrical Disturbances in Transmission Work," by D. B. Rushmore. (4) Paper, "The Transmission Systems of the World Operating at and Above 70,000 Volts," by Selby Haar. (5) Report on permanent methods of measuring water in water power plants, by D. W. Mead. (6) Paper, "Water Power Plant Economics," by O. B. Coldwell (presented in full in this issue.) (7) Illustrated address, Hydroelectric Work in California," by John A. Britton.

Thursday, June 4, 2:30 p. m.

Second hydroelectric session held in conjunction with third technical session.

Accounting Sessions.

Tuesday, June 2, 2:30 p. m.

(1) Address of the chairman of section, by H. M. Edwards. (2) Report of library committee, by C. L. Campbell. (3) Report of "Question Box" committee, by E. C. Scobell. (4) Paper, "Cost and Statistics," by T. J. Walsh.

Wednesday, June 3, 10 a. m.

(1) Report of committee on uniform system of accounts, by J. L. Bailey. (2) Address, "Appraisals," by D. C. Jackson. (3) Paper, "Variation in Public Service Systems of Accounting," by E. C. Scobell.

Thursday, June 4, 10 a. m.

(1) Paper, "Accounting for Merchandise Sales," by H. B. Lohmeyer. (2) Paper, "Suspense Accounts," by Fred Schmitt. (3) Paper, "Mechanical Sorting and Tabulating Systems," (a) in connection with disbursement accounts, by F. A. Birch; (b) as applied to inventory of transmission and distribution systems, by G. L. Knight and C. V. Woolsey. (5) Paper, "Purchasing, Storing and Accounting of Coal for the New York Edison Company," by C. R. Lehmann.

POWER PLOWING.

Following the example set by landowners in the department of Emilia, some experiments have recently been made near Florence in plowing by electricity.

The advantages claimed for this system of power plowing are: (1) The small cost of equipment as compared with other mechanical systems of plowing; (2) the lower cost of maintenance; (3) the need of a smaller number of laborers; (4) the fact that during stoppages from any cause the current may be cut off from the motors, thereby stopping at once the expense for power; (5) the availability of the surplus power from the motors and transformers for use in other work.

The stationary apparatus drawing energy from some commercial electric line consists of transformers, motors from 25 to 50 h.p., motor-driven capstan, and hauling cable. The running apparatus is made up of a leading truck and wheeled plows. It is stated that 89 acres can be plowed without shifting the stationary plant.

At Gazzo Veronese the following estimates of the cost per acre of plowing were made: Plowing with animals, $5.30 to $5.75; steam power, $4.30; electric power, $3. The plowing was done to a depth of 35 to 40 centimeters (13.78 to 15.75 in.) and the foregoing cost of electric plowing is figured on the basis of 200 days' work per year with electric power at the rate of 3 cents per kw.-hr. In the same district for 100 days' work in the year with the price of electric power at 4 cents per kw.-hr., the comparative costs per acre of steam and electric plowing were: Steam plowing, $5.07; electric plowing, $3.35. Other plants in the same district are said to have reduced the cost of electric plowing to $2.83 per acre.

Calculations made at Reggio Emilia on 741 acres plowed by electric power gave the following results:

Capital Invested.

8 km. of line, 10,000 volts	$ 2,880
2 sets of motors and transformers, 50 h.p. each	2,000
2 capstans, platform plows, etc.	3,400
Total	$ 8,280

Operating Expenses.

13 per cent of amount invested in line	$ 374
15 per cent of amount invested in motors, etc.	300
20 per cent of amount invested in plows, etc.	680
Cost of current, 118,656 h.p.-hr. (cost per h.p.-hr., $0.0162)	1,920
Labor for operation of motors and transformers, 2 men, 100 days, at $1 per day	200
Labor for capstans and plows, 4 men, 200 days at $0.80 per day	640
Oil and lubricants for the motors	40
Oil and lubricants for the capstan and cable	30
Labor insurance	20
Superintendence	120
Total	$ 4,324
Electricity consumed for 741 acres, kw.-hr.	30,000
Loss in transmission and transforming, 10 per cent, kw.-hr.	3,000
Loss in energy by motors running without load, kw.-hr.	2,100
Total (equal to 17,736 h.p.-hr., kw.-hr)	35,100
Energy generated at cost of $1,920, h.p.-hr.	118,656
Used in plowing, h.p.-hr.	47,736
Balance, h.p.-hr.	70,920

For other systems (those using a moving engine) of plowing a similar parcel of land figured on the same basis the costs as calculated are: Plowing with steam power, $4,360; gas engine, $4,368; oil burning engine, $4,285.

The cost of fuel in this district is approximately as follows: Coal, per metric ton, $12; wood, per quintal (220 lb.), $0.80; gasoline, per 5-gal. tin, $1.80; kerosene, per quintal, $7.

RAIL AND STEAMSHIP TERMINAL FREIGHT HANDLING.

BY W. D. PEASLEE.

[Concluded.]

Between the cars and dock it has been shown that 502.5 tons per day are to be handled which will require under the present system of manual labor no less than 90 men. As the work is steady, a rate of 25c per hour will be paid and the cost will be $90 \times 25 \times 9 = \$202.50$ per day or \$.403 per ton, and $150{,}750 \times .403 = \$60{,}752.25$ per year, since weighing, marking, checking and superintendence for this work will be taken care of by the men whose time has already been charged against the cost of handling between the vessel and dock.

Under the proposed system the cost will be: $150{,}750 \times .15 = \$22{,}612.50$ per year, since the depreciation and taxes and insurance charges have been included in the handling between the vessel and dock as well as weighing, marking, checking and superintendence. It would undoubtedly be more correct to apply a part of the fixed charges and weighing, marking, checking and superintendence to this cost but it would be difficult to determine just what part should be in each case. The entire amount has therefore, been applied to the cost of handling between the vessel and dock.

The yearly saving in this operation is \$38,139.75 and the total saving in handling charges under the conditions assumed is \$130,398.25, a return on the investment of 269 per cent per annum.

If cars were available so that the reship cargo could be handled from the ship direct to the cars it would reduce the cost of handling that freight by the elimination of one loading and one unloading of the trucks. This would have been paid for at \$.25 per hour and would be a saving of 4 men-min. or \$.0166 per ton.

To transfer the freight in this manner under the present system would add to the cost of handling between the dock and vessel the cost of trucking the extra 400 ft. at \$.55 per hour on the freight handled direct from the ship to the cars. Time studies show that men will average 135 ft. per min. with hand trucks, so the extra 800 ft. travel will take 6 min. With miscellaneous freight each truck load will average 380 lb., so that 5.3 trips per ton will be required. The extra work of loading from the ship to the cars over the cost from the ship to the dock is 31.8 men-min. and costs \$.2915 per ton. The saving by the elimination of the double handle is \$.017 as shown so the net increase is \$.2745 per ton and the cost of unloading from the vessel to the cars is \$.8075 per ton plus the cost of checking, weighing, marking and superintendence.

A larger force will be required to unload the ship in the same time under these conditions and using the common labor to help unload in the cars probably 30 extra stevedores will be necessary. Under the proposed system the common labor would help unload in the cars and the trucks used at other times between the dock and cars would operate between the cars and ship so that by this arrangement no additional force will then be required.

Taking the labor cost of the present system as 100 per cent and subdivision (which for the convenience of the reader is here reproduced) since no change has been made in the items of weighing, checking, marking and superintendence in the proposed installation, as shown in Fig. 1, the labor and handling costs in the cases discussed can now be compared.

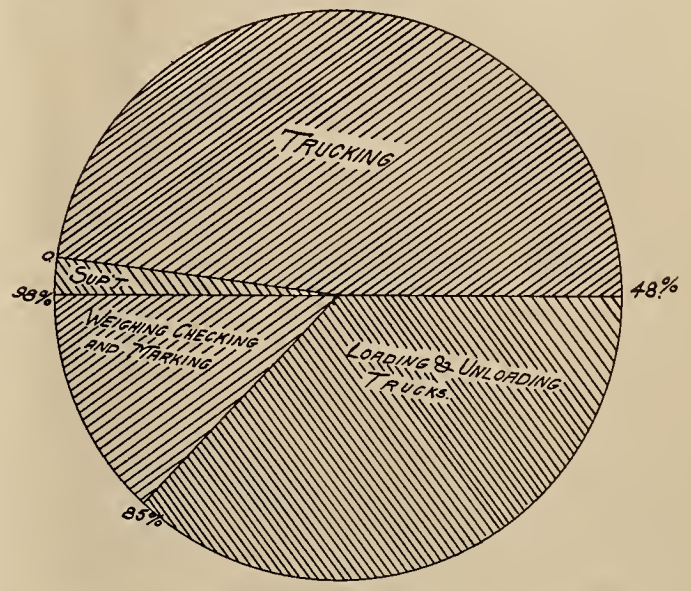


Fig. 1. Showing Division of Labor Costs in Average Terminal. Manual Trucking and Handling.

Case 1. Present system, handling freight by stevedore labor between dock and vessel and later by common labor between dock and cars.

Stevedore labor	$120 \times .55 \times 90 = \$160{,}380.00$
Common labor	$90 \times .25 \times 300 \times 9 = 60{,}752.25$
Total, less checkers, weighers, markers and superintendence (from Fig. 1), 85 per cent.	\$221,132.25
Checkers, weighers, markers and superintendence.	\$39,023.90
Total labor	\$260,156.15

Case 2. Proposed system, handling between vessel and dock and later between dock and cars.

Stevedores	$64 \times 14\frac{1}{4} \times 90 = \$45{,}144.00$
Common labor	$24 \times 25 \times 300 \times 9 = 16{,}200.00$
Note—This includes 3¾ hr. per day of 4 men in excess of the labor needed.	
Checkers, weighers, markers and superintendence.	39,023.90
Total labor cost	\$100,367.90

Taking the labor cost in Case 1 as 100, this labor cost is 38.5 per cent.

Case 3. Stevedores handling freight between dock and vessel and half of the incoming cargo direct to the cars.

Stevedores	$150 \times 27 \times .55 \times 90 = \$200{,}475.00$
Common labor	$90 \times .25 \times 300 \times 9 = 60{,}752.25$
Checkers, weigher, markers and superintendence	39,023.90
Total labor cost	\$300,251.15
Checkers, weighers, markers and superintendence.	39,023.90

Case 4. Proposed system under conditions of Case 3.

Stevedores as in Case 2	\$45,144.00
Common labor as in Case 2	16,200.00
Checkers, weighers, markers and superintendence.	39,023.90
Total labor cost	\$100,367.90

Taking the labor cost in Case 3 as 100, this labor cost is 33.4 per cent. The operating cost of trucks will be found to be as follows:

Between ship and dock at $.50 per hr., 26 × .50 × 14¼ × 90 = ... $16,672.50

Between cars and dock and in Case 4 helping unload ship, 6 × 300 × 9 × 50 = ... 8,100.00

Note.—This includes 3¾ hr. per day time of one truck not needed to handle freight.

Depreciation at 10 per cent..... 4,850.90

Taxes and insurance at 3 per cent..... 1,455.00

Total operating cost proposed system..... $31,077.50

Then for the four cases discussed:

	Labor cost per year.	Handling cost per year.
Case 1	$260,156.15	$260,156.16
Cast 2	100,367.90	*131,445.40
Case 3	300,251.15	300,251.15
Case 4	100,367.90	*131,445.40

*Owing to the fact that this figure includes 3¾ hr. per day operation of one truck and 4 men it is high by that amount but since any slight accident will render the use of this extra time necessary it has not been taken out of the handling cost of the proposed system.

Summarized Comparison.

	Present system.	Proposed system.	Saving.
Time to unload 1250 tons	9 hr.	5¼ hr.	3¾ hr.
Time to load 2100 tons	18 hr.	9 hr.	9 hr.
Tons per yr. dock to vessel	189,000	189,000	
Tons per yr. vessel to dock or cars	112,500	112,500	
Tons per yr. between cars and dock	150,750	150,750	
Total yearly tonnage of terminal	301,500	301,500	
Handling freight between vessel and dock and later, half again between docks and cars.			
Average labor cost of handling	$.863	$.333	$.53
Average total handling cost	.863	.436	.427
Handling freight between vessel and dock unloading half of incoming cargo direct to cars.			
Average labor cost for terminal	$.998	$.333	$.665
Average total handling cost	.998	.436	.562
Cost of 400 ft. extra trucking less cost of double handling of freight loaded from ship to cars	.2745	.133	.1415
Checkers, markers, weighers and supt.	.1293	.1293	
Cost of handling between ship or dock	.6623	.3553	.307
Cost of handling between dock & cars	.403	.15	.253
Cost of handling vessel to cars	.9368	.4883	.4485
Cost vessel to dock and dock to cars	1.0653	.5053	.56

Note.—The above costs are all worked out on a tonnage basis.

This table shows the increasing advantage of mechanical over hand trucking with increasing trucking distance. For distances of 1000 ft. or more it is usually economical to use tractors hauling trailers as this reduces the initial investment.

When large or unwieldy pieces are encountered the advantages of the mechanical system will be greater as the trucks equipped with cranes will pick up and carry pieces weighing a ton or more from where they are deposited by the ships hoist to the cars and load them into the cars at a cost very close to $.11 per piece while to move the same piece by hand over the same distance will take ten men half an hour at the best and cost $1.25 if done with common labor. Both these figures are taken from actual cases met with at Pacific Coast Terminals.

The statistics given in this paper may seem extreme but they are based on actual experience and time studies by the author and others and may be taken as showing, within a reasonable degree of accuracy, what may be accomplished by the proper application of mechanical methods to freight handling.

It will be seen that even where the equipment is to be installed in an existing building where extensive changes cannot be made without excessive cost, a careful study of the local conditions will enable the designer to select an equipment that will handle the freight with greater dispatch, equal safety and at much less cost than it can be handled by the common method of loading, trucking unloading and piling by manual effort. Particular attention must be paid to the kind of freight to be handled as this will have a marked effect on the type of equipment used and the costs encountered.

Care must be used in applying the figure given in the above analysis as they will apply only to the case and conditions assumed, though these have been taken as nearly as possible representative of Pacific Coast conditions, and the equipment described might not be at all suitable for a set of conditions seeming at first glance very similar. Each case must be analyzed on its own peculiar conditions, but the method outlined has proved valuable in the investigation of terminal problems and affords a means of comparing different equipments on a common basis.

It is to be hoped that the day is not far distant when both terminals and ships will be designed for the efficient handling of freight at terminals, for it is only by co-operation of all interests involved that the cost of terminal freight handling can be reduced to a figure commensurate with the cost of its transportation, and the burden of the excessive handling cost now borne by the consumer, considerably decreased.

A Diesel engine central station plant is being installed at Duncan, B. C., to be in operation by September 1 of the present year. It has been announced that the rates will then be reduced to 15c for the first 50 kw.-hr. 12½c for the next 50 kw.-hr. and 10c for all in excess of this amount with 20 per cent discount for prompt payment.

Asphalt-paper pipes for which numerous advantages over pipes of other materials are claimed are being introduced in Austria. Originally, the paper pipes were employed for electric cable conduits, but other uses have now been found for them, and the makers assert they can replace iron, steel, copper, and clay piping for all purposes except the conveyance of hot fluids, concentrated acids, and petroleum products. The pipes are made from a special kind of asphalt paper of German manufacture (the paper made in Austria not being wide enough), are exceedingly light in weight compared with metallic or clay piping, and, in addition, are flexible to a slight degree. They are not affected by sudden changes of temperature, nor do the stray currents of street railway systems cause electrolysis of buried mains. The patents covering the process and the machinery for making the pipes are owned by the Anglo-Austrian Bank of Vienna; application has been made for American patents on both. Up to this time no machine-made pipes have been produced, as the machinery has only recently been perfected.

GAS AND ELECTRICAL DEVELOPMENT IN CENTRAL CALIFORNIA.

This development is interestingly indicated in part in a report just issued by the Pacific Gas & Electric Company covering the operations of that country during the year 1913 and giving comparative statistics with other years.

Improvement in the high load factor of this company which is now among the highest of all comparable companies in the United States and the generating capacity is referred to in the following paragraphs and tables:

The significance of the company's load factor of 59 per cent may be inferred from the fact that the load factors of the electric companies operating in the largest cities in the country, namely, New York, Chicago, Philadelphia, Brooklyn and Boston, ranged from 33 per cent to 40 per cent in 1913. The company's favorable position in this respect is attributable to the large power load it has steadily built up practically from the time of the first utilization of the State's water power resources for the production of electric energy.

Since the organization of the company its entire electric system has been welded into what is virtually a single operating unit, all of the various plants being so interconnected and controlled that it is possible, in case of accident or variation in load, to switch very quickly from one to another of the various power houses and transmission lines. This insures continuity of service throughout the entire field of operations and is an important element of strength, particularly in view of the necessity of uninterrupted service to the many important industries dependent upon the company for power.

Electric Generating Statistics.

Year.	Hydroelectric Plants Installation No.	Hydroelectric Plants Installation in H.P.	Steam Electric Plants Installation No.	Steam Electric Plants Installation in H.P.	System Load Factor for year (Per Cent)	Peak Demand on System in H.P.
1906	9	75,200	6	42,315	....	63,672
1907	10	85,600	7	52,437	....	83,908
1908	11	92,973	7	52,437	....	89,733
1909	11	92,973	5	60,266	....	134,012
1910	11	92,973	4	44,266	....	128,269
1911	11	92,973	4	58,266	57.4	141,469
1912	9	90,227	4	94,100	58.6	145,000
1913	10	123,740	4	110,188	59.0	160,819

Comparative statistics of the gross revenue of this company from electric sales together with a classification of the amounts from different classes of business is an interesting commentary on the direction and volume of business growth.

Gross Revenue from Electric Sales.

Classification.	Year 1913.	Year 1912.	Increase.
Commercial and Residential Business	$3,642,836.95	$3,457,064.85	$185,772.10
State, County and Municipal Business	662,566.21	680,339.19	—17,772.98
Sales of Power—Agricultural Industry	419,092.83	195,883.72	223,209.11
Sales of Power—Mining Industry	557,461.76	576,785.22	—19,323.46
Sales of Power—Transportation Industry	696,324.41	627,763.14	68,561.27
Sales of Power—Manufacturing Industry	1,476,104.59	1,436,643.66	39,460.93
Sales of Power—other Electric Light and Power Corporations	343,429.94	305,162.64	38,267.30
Temporary Lighting and Sales of Power—Commercial and Miscellaneous.	431,327.41	391,566.83	39,770.58
Power	1,627.81	1,361.25	266.56
Totals	$8,230,781.91	$7,672,570.50	$558,211.41

One of the economies of operation which indicates the conservation of efficiency or the value of applied engineering progress is brought out in the following paragraphs:

If the efficiency of this plant in the year 1913 had been no greater than it was in the year 1907, the fuel bill for 1913 would have been $225,000 greater. In this respect the plant was 63 per cent more efficient in 1913 than it was in 1907.

Regarding the consideration of the property value of water rights and its established and important bearing upon rate-making the following comment is made:

The Supreme Court of the United States, in a decision rendered by it on April 27, 1914, in the case of the San Joaquin and Kings River Canal & Irrigation Company vs. The County of Stanislaus et al., held that water rights are property, the value of which must be considered in the fixing of rates by public authorities. This was a reversal of the decision of the lower Federal Court. In view of the fact that your company, in addition to 100,000 h.p. of undeveloped water rights, has an installed capacity of 123,740 h.p. in its hydroelectric plants, and has other water powers under development at this time which will bring this installed capacity up to 281,157 horsepower, the importance of this decision as affecting your interests is obvious and confirms the opinion we have hereofore held that this company's water rights, have a very large pecuniary value.

The permanence of the franchises of the company is also referred to in the report as follows:

By its unanimous decision of April 6, 1914, in the case of Russell vs. Sebastian, in the argument of which counsel for this company participated, the Supreme Court of the United States established the fact beyond any further question, that the franchises secured under the authority of the state constitution prior to its amendment on October 10, 1911, under which this company is supplying gas and electric light and water in the large number of municipalities served by it, are vested property rights of perpetual duration, and include the right of making all necessary extensions within such municipalities upon the terms of the original grant. By a general law of the state, no franchise of any description may now be granted except upon condition that the purchaser pay at least 2 per cent of the gross annual receipts derived from its exercise. In the case of cities, governed by freeholders' charters, the conditions upon which franchises are granted are in general more onerous than those prescribed by this general law of the state. The importance of this decision will, therefore, be more fully appreciated when it is considered that the above-mentioned franchises of this company are not only without time limit, but are also not subject in any special rental, charge or burden of any kind.

The climate of California, both in the coast cities and in the interior valleys, coupled with the generally high retail prices for coal and wood, is peculiarly adapted to the development of a large gas business, especially for cooking and heating. Commenting on this the report says:

Gas is also being used in the company's territory in an increasing degree for industrial purposes. Among these may be mentioned the manufacture of cans, varnishes, barrels, etc., the operation of linotype and laundry machines, the roasting of coffee and the manufacture of jewelry and smelting of precious metals. One consumer of this class alone uses more than 20,000,000 cu. ft. of gas per annum. The company manufactures its gas exclusively from crude oil under a process developed by its own staff. The chief characteristics of this process are the ease and economy with which the oil is handled as compared with coal, coke, etc., the almost entire absence of residuals and waste materials, the flexible capacity of the works and, consequent upon these, the comparative economy in labor employed at the works.

Gas Department Statistics.

Year.	Number of Gas Plants.	Total Daily Capacity of Generators Cubic Feet.	Miles of Gas Mains.	Number of Gas Street Lamps.
1906	14	16,440,000	1,147.26	3,607
1907	14	27,640,000	1,269.62	4,491
1908	14	33,980,000	1,329.53	4,922
1909	14	34,280,000	1,447.03	4,956
1910	14	34,680,000	1,634.21	5,499
1911	16	34,680,000	1,917.71	8,342
1912	17	44,710,000	2,201.00	8,442
1913	17	44,710,000	2,374.18	8,924

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Where Every Prospect Pleases

Recent statistics published by the Census Bureau proved the Pacific Coast pre-eminent in electrical development, the summary as published in this journal, clearly indicating this enviable position.

Reference shows that the average annual per capita expenditure in the West for electric light and power was much higher than the average for the East. These figures were naturally questioned and especially with reference to the state of California, it was thought that there must be some mistake.

The eighth annual report just issued by the Pacific Gas & Electric Company is a corroboration, if such were necessary, of the statistics referred to, as this company's revenue per consumer is shown to be over sixty-two dollars.

Due to a greater proportional increase in the number of residence consumers this average shows a slight decrease but this cannot be appreciable or constant, as the West, due to intensive development, has no future problem of the small consumer.

It is not uncommon to find practically every residence of whatever kind, in Pacific Coast cities, connected to the lighting company's system.

Though this is true, it does not represent a saturated business situation.

Among the most remarkable features of the report referred to is the astounding increase during 1913 in the agricultural business of this company, and the vast possibilities of business expansion along this line may perhaps be more readily grasped when it is learned that at present the acreage wholly or partially served by the company is but three hundred thousand, a beggarly 4.28 per cent of the possible land, contiguous to the company's system, which may be brought under cultivation; a circumstance of further electrical expansion.

In developing this rural load, the West is creating opportunity and causing a tremendously increased business in all departments—generation, transmission, distribution and utilization.

It is impossible to pass over this situation without commenting upon the economic importance at this time of the private ownership of electric light and power utilities.

The municipal is, by its very nature, local and limited, self-centered and centripetal, while the operations of a private corporation are extensive and its power centrifugal, in its desire for growth.

In thus extending its operations the private corporation creates a service which builds up the rural districts, makes the growth and continuity of cities possible, and the prosperity of the state more certain.

In catering to this class of business with its enormous possibilities, the manufacturing end of the electrical industry is greatly stimulated, especially the appliance manufacturer, for gas, the electrical heating and cooking competitor of the city does not reach far out into rural districts which with the advent of electricity for light and power are rapidly adopting it for cooking and heating also.

When it is realized that the state of California is easily capable of supporting twenty times its present population and other Pacific Coast states proportional additions, and that population increases in this terri-

tory are greater than in any other part of the United States, the prospect of increased electrical business is indeed pleasing and the saturation point of electrical expenditures does not appear even as a speck upon the horizon of this vast electrical prosperity.

A Variable Standard

The method of determining the quality of gas varies widely, both as regards the standard required, and whether it shall be determined by the use of the photometer, by the calorimeter, or both.

It would appear that progress in the art of manufacturing gas has now reached the point where the use of the photometer and of standards requiring its use in their determination, is not only unnecessary, but renders service to the consumer of a lower value than is otherwise possible.

The elastic standard of lighting, meaning the progressive intensities required for different classes of service, is common usage. For various reasons, standards of quality of gas seem also unable to find a common basis, and while the method of their determination is, in most places, in accord with the regulations, the means used are essentially antiquated.

Standards of quality of gas are inconstant; and hence there is no standard unless it is allowed that a standard may be variable, as is the case in lighting.

Different authorities throughout the world are satisfied with or insist upon standards of quality of gas which vary in heating value, for example, as high as 37 per cent.

With the lapse of time, from the days of gas for lighting purposes only, to the present day of gas for all purposes, and the attendant necessary changes in the product and improvement in the appliances used there has resulted the need for a change, not only in the quality of the gas used, but in the method of determining that quality.

Open flame burners were the only excuse for adhering to the candle power or photometric standard of quality, but due to the general use of incandescent mantles, or their possible use for all purposes, together with the wide use of domestic and industrial heating appliances, gas is perhaps more valuable for its calorimetric, than for its light giving value.

With the use of available improved appliances, a better and more economical light may be produced with non-luminous than with luminous gas.

Due, however, to the use of different methods in the production of gas, it is questionable whether one standard could be generally adopted, especially if a so-called low standard is decided upon which, though perhaps most advantageous to the larger companies, might not be looked upon with favor by the smaller ones.

Commercial efficiency in the gas industry is controlled in large degree by the question of by-products; the economics of their extraction, the market and so forth. In that salable by-products reduce overhead, their utilization, unless most essential for the economic production of gas, would appear to be fallacious, and for this reason, the standard ultimately adopted should represent the highest possible conservation of utilization.

To successfully adopt this standard will require gas companies, notwithstanding the increased value of their product, to conduct a campaign of publicity, in order to overcome the present inertia of custom, and to permit their being able, with the willing consent of the public, to do this, and thus be able to discontinue entirely the antiquated and meaningless photometric approximation of the quality of gas together with the elimination of the unnecessary qualities implied as then existing, and to adopt a sane standard of heating value—a practical measure of the actual service now required.

Electrical Estimates

It is difficult indeed to understand the tardiness which obtains with reference to the adoption of quantity surveying though the losses due to its non-adoption are certain as is the fact that this omission occurs in an age in which the elimination of waste is almost a worship which bids fair in the future years to label these days, "The Age of Efficiency."

Custom is almost a curse.

Perhaps the reason for the delay is that the change of method in its entirety, is of such magnitude.

For this reason it may be a far cry to the establishment of the American Institute of Quantity Surveyors, but in the interim there is no reason why individual trades should not take preliminary steps toward more economic practice.

Even granted, for example, that a specification complete in every detail has been drawn up by a consulting electrical engineer for the architect, it still becomes necessary, when bids are called, for each electrical contractor to interpret them and to individually take-off the quantities before making his estimates.

The undesirable feature which here enters, notwithstanding standardization of methods, is the large percentage of errors made and the contracts awarded on the resultant low estimates which in turn react upon those contractors estimating correctly.

The enormous waste of the present practice is emphasized in the small percentage of jobs secured as compared with those estimated; ten per cent, it is stated, being a fairly high average.

This situation and loss causing an increasing overhead calls for immediate relief.

Pending the general acceptance and recognition of quantity surveying the logical step is that the electrical contractors' organization in each city, as an instantial case, should employ a quantity surveyor and staff under the supervision of the association secretary, to take-off the quantities on all jobs.

These men could be selected from among the best of those now engaged in this work and their specialized and concentrated effort would then result to their advantage also in increased salaries.

The surveyors' work accomplished the quantity sheets could be released simultaneously to member contractors required by the owner to bid.

This would tend to largely destroy the present undesirable features of electrical contracting and in reducing overhead would further the interests of those contractors whose desire, in matters for mutuality, is to operate together, while at the same time allowing more time to be devoted to business expansion.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

C. W. Lillard, Pacific Coast manager Gould Storage Battery Company, is at Salt Lake City.

H. C. Kennedy of the American Electric Heater Company was at Seattle last week and is at present in Portland.

F. L. Webster, Pacific Coast manager Allis-Chalmers Mfg. Company, returned to San Francisco from a trip to Milwaukee.

J. A. Ryan, sales manager of the Western Electric Company at Portland, recently spent a few days at the Seattle office.

R. Q. Cleavenger, sales representative of the Phoenix Glass Company, is at San Francisco and will visit other Pacific Coast cities.

H. V. Carter, president Pacific States Electric Company has just returned to San Francisco from a trip through central and southern California.

F. D. Fagan, sales manager of the San Francisco office of the Edison Lamp Works of General Electric Company has left on a visit to New York.

J. B. Rowray, of Chico, superintendent of the Northern Electric road has assumed the office of acting general manager, succeeding **A. D. Schindler,** resigned.

C. B. Babcock, manager Pacific Coast office General Gas Light Company, has left on an extended business trip through the Pacific Northwest, and western Canada.

Bion J. Arnold of Chicago, the traction expert, addressed the Commonwealth Club of San Francisco during the past week regarding the acquisition of municipal railways.

J. C. Drake, who was manager for the Snoqualmie Falls Power Company for several years, has been placed in the office of the commissioner of light and water at Tacoma.

W. Crighton Harris has resigned from the engineering firm of Crighton, Harris & Company, to become chief engineer of the Titan Storage Battery Company of Newark, N. J.

J. C. Scrugham, professor of mechanical engineering, state university of Nevada, and identified with many matters of electrical interest in Nevada, visited San Francisco during the past week.

Douglas Allmond has been elected president and manager of the Anacortes Light & Power Company, Anacortes, Washington. This company has taken over the holdings of the old Anacortes Water Company.

A. B. Richmond, secretary of the Olston Electric Stove Company, Los Angeles, Cal., has been spending the past ten days at San Francisco and last Tuesday was a guest of the Electrical Development League.

M. McIntyre, formerly general manager of the Napa & Calistoga Electric line, has been appointed traffic manager of the Central California Traction Company, to fill the vacancy created by the resignation of **S. W. Barnes.**

A. D. Schindler, vice-president and general manager of the Northern Electric, has resigned and will now devote his attention to private interests in Southern California. He was formerly general manager of the Pacific Electric system in Los Angeles.

E. K. Dyer is president and general manager of the reorganized firm of Dyer & Crawford, electrical dealers and contractors, Oakland, Cal. **J. W. Carfe,** vice-president and treasurer, is a new member of the firm, **V. F. Crawford** being secretary and assistant treasurer.

Alton W. Leonard, vice-president Puget Sound Traction, Light & Power Company is now executive head of that corporation following the death of President Jacob Furth. Mr. Leonard has been carrying out the duties of the president's office for some time. There will be no immediate changes in the staff.

F. V. Cook of Seattle, Wash., special salesman for the Ohio Brass Company, Mansfield, Ohio, sustained serious injuries in the automobile accident at Ogden Canyon which resulted also in the drowning of Walter E. Read. **Q. W. Hershey** of Pittsburg, Pa., special engineer of the Westinghouse Company, was also injured.

George A. Boomer, Pacific Coast representative of Plume & Atwood Manufacturing Company, is visiting the different cities in the Pacific Northwest. **Sylvester M. Baker** of the Macbeth, Evan Glass Company, is also visiting the same cities, at the same time and for the same period. (At least if he is not, he ought to be.—Eds.)

F. H. Barber, sales manager of the Western Electric Company in Salt Lake City, has been transferred to the company's office at Dallas, where he will take charge of the sales department. Mr. Barber has been connected with the electrical industry in Salt Lake for the past four or five years and has a host of friends who will regret his departure to his new field of labor.

W. E. Herring, industrial agent Puget Sound Traction, Light & Power Company, has returned to Seattle from an extended eastern trip during which he visited the leading cities of the east and middle west and succeeded in interesting a number of manufacturers in the territory served by his company. He expects as a result of his trip that a number of industrial plants will be established in the state of Washington.

W. T. Wallace of the firm of Sanderson & Porter, the newly appointed general manager of the Great Shoshone & Twin Falls Power Company, Twin Falls, Idaho, has assumed office and has the reorganization plans for this company well under way. It is early to say just what program has been mapped out for the rehabilitation for this company, which was involved in the failure of the Kuhn interests at Pittsburg, but all along the line there is an optimistic feeling that teh company will soon be operating under normal conditions.

John F. Heath, until recently county salesman for the Independent Electric Supply Company, Los Angeles, Cal., together with **C. F. McDonald,** previously chief engineer, Western Construction Company, both Jovians, are at San Francisco on the first leg of a trip around the world. The trip will occupy about 18 months and will take them through the Panama canal up to New York, through Europe, to Australasia and Japan from which country the return trip will be made to Seattle and via coast cities to Los Angeles. The journey results from a wager.

W. A. Thomas, who for several years past has been commercial engineer in charge of all sales of mining apparatus for the Westinghouse Electric and Manufacturing Company, with headquarters at East Pittsburgh, resigned his position with this company on June 1, and has taken up the practice of consulting engineer in Pittsburgh, with offices in the Second National Bank Building. His training in practical mining work, coupled with his work with the large electrical companies and extensive experience with mining companies, should peculiarly fit Mr. Thomas for the new work which he has chosen. He will specialize on mining.

E. G. Hopson has been appointed by the American Society of Civil Engineers as one of a committee of three to recommend the award of medals and prizes for the society. The awards will consist of the James R. Cross medal, the Thomas Fitch Rowland prize, the James Laurie prize and the Collingwood prize for juniors. The various awards are for technical accomplishments in engineering work during the past year. The choice of a Portland engineer among the thousands of engineers throughout the country for this service is regarded as a very considerable distinction. Mr. Hopson is district engineer of the reclamation service and president of the Portland, Ore., Association of the American Society of Civil Engineers.

E. H. Eardley of the Eardley Bros. Electric Company; **F. S. Hartzell** of the General Electric Company; **Curtis B. Hawley** of the Inter-Mountain Electric Company; **A. H. De Nike, C. C. Campbell** and **J. F. Greenwald**, of the Mountain States Telephone and Telegraph Company; **R. S. Folland** of the Capital Electric Company, and **B. W. Mendenhall** of the Utah Light and Railway Company, all of Salt Lake City, returned last Saturday from the Commercial Club Trade Excursion which they accompanied into Northern Utah and Southern Idaho last week. That the electrical industry should have eight representatives out of a total of seventy business men on the excursion is an indication of the importance which the electrical industry has assumed in the business community.

OBITUARY.

Walter E. Read, 37 years of age, master mechanic for the Ogden Rapid Transit Company, was drowned and two companions were injured when the automobile in which they were riding left the roadway a short distance west of the Lewis summer camp in Ogden Canyon, and plunged over an embankment into the river at 10 o'clock on the night of May 31st. Mr. Read is the son of W. P. Read of Ogden, Utah, where he resided. For many years he was connected with the old Salt Lake City Street Car Company, of which his father was superintendent. He went to Ogden about ten years ago to take a position with the street car company in that city, and rose to the position of master mechanic. He leaves a wife and 12-year-old daughter.

MEETING NOTICES.

Seattle Engineers' Club.

The club met at luncheon Thursday, May 28th, at the College Club quarters, when Lawrence J. Colman, head of the well known Colman Creosoting Company of Seattle, addressed the club on "The Comparison of Creosoting Processes."

Portland Section A. I. E. E.

The regular business meeting and informal banquet was held at the Multnomah Hotel, Portland, Ore., at 6:30 p. m. on the evening of June 2d. Officers were elected for the ensuing year, as follows: R. F. Monges, chairman; Paul Lebenbaum, secretary-treasurer, and C. P. Nock, L. R. Elder and L. T. Merwin an executive committee. G. P. Nock will be the official delegate to the national convention of the association to be held this year at Detroit, Mich. During the banquet excellent entertainment was provided for the guests who numbered about forty.

The Jovian Electrical League of Southern California.

The luncheon at Christopher's on Wednesday, June 3, was well attended. After the customary introductions of guests, a splendid musical program was rendered by artists from local theaters. Chairman Colkitt announced the annual Jovian picnic, which will be held on June 20. The league, by a unanimous vote, declared itself against the proposed eight-hour law. A splendid lecture was then delivered on "General Organization" by former Assistant United States District Attorney Edward A. Regan. The speaker gave high praise to the spirit of commercial co-operation as practiced by the Jovian order and declared that the attitude of the Government towards business is one of great latitude. He urged his hearers to keep in close touch with legislation and see to it that acts which are passed should be enforced as they were intended to be. The chairman of the day was John C. Rendler.

San Francisco Electrical Development and Jovian League.

The semi- annual meeting of the Electrical Development and Jovian League was held Tuesday, June 9. In addition to the regular routine business, the report of the nominating committee appointed at the previous meeting to select and report on a list of candidates for the offices of president, vice-president and two members of the executive committee was adopted as a whole and the secretary instructed to cast the ballot. The new officers elected to serve for the term commencing July 1, 1914, are: C. Heise (Westinghouse Electric and Manufacturing Company), president; H. R. Noack (Pierson, Roeding & Co.), vice-president; members of the executive committee, Garnett Young and E. B. Cutting. Among the several visitors present were A. B. Richmond, Los Angeles, who gave some remarks on the advantages of electric cooking in the home, and John F. Heath, also of Los Angeles, and who is starting on a trip around the globe, told his brother Jovians how he expected to accomplish it by using his wits.

Los Angeles Section, A. I. E. E.

Members of the Los Angeles section of the A. I. E. E. journeyed to the engineering building of the University of Southern California on the evening of May 26, in order to listen to and take part in a symposium on "The Proper Method of Teaching Electrical Engineering." The subject was introduced by the reading of a highly interesting and original thesis on the development and construction of models for class room work, by Ernest Le Roy Arnold and David Beard Munroe. The models and charts dealt with the following problems: "The Number of Windings Possible," "The Voltage Drop," "A Graphic Representation of Generator Field Action," "The Different Actions That Are Occurring in an Induction Motor," "The Theory of Commutation," "The Building Up and Decreasing of the Flux in Each Phase of a 3-Phase Transformer With Respect to the Other Two Phases."

The thesis, which presents many original viewpoints and will be printed in a later issue, was undertaken at the suggestion of Professor Nye and has been an endeavor to present by means of models, demonstrations and suggestions some of the various fundamental ideas met with in the treatment of electrical subjects.

The interesting and lively discussion which followed, was opened by Prof. Nye, who gave a brief outline of the electrical engineering course at the U. S. C. He stated that: "The question of what should be taught to students in electrical engineering and how it should be taught will never receive a definite and final answer since the rapid development of the profession calls for frequent changes in the school system. Every so often the teaching engineer must come to the operating engineer with the question: "Are the technical men receiving the proper training, if not, what do you advise?" He then suggested twelve questions for discussion. In conclusion Prof. Nye made a plea for better operating positions for technical men. A large number of professional men and operating engineers participated in the discussion which followed and it appeared to be the consensus of opinion that the course should be so laid out as to compel the student to search for the answers to his problems, as he will have to do after he leaves college and to include also a certain amount of business training and the proper understanding and use of commercial laws and practices.

Before adjournment the section endorsed Harris J. Ryan for the presidency of the institute.

PORTLAND FIRE ALARM SYSTEM.

As it might be inferred from the title of our leading article of last week, "Portland Fire Alarm System," that it referred to a description of the municipal alarm system, it is desired that we state, as the text clearly shows, that the article deals with a private manual fire alarm system operating over the Home Telephone Company's (automatic) system.

ELECTRICAL CONTRACTORS' DEPARTMENT

ELECTRICAL CONTRACTORS' PICNIC.

The California Electrical Contractors' Association—Local No. 1—held their third annual outing Saturday, June 6, at Monticello Grove, Marin county. While the weather sages did not provide as favorable weather as might have been, yet the party were not discouraged, nor the enthusiasm lessened. They had gathered for a day of fun and fun they had. Under



All Aboard for the Contractors' Picnic.

the guidance of Secretary W. S. Hanbridge and the genial Capt. Leale of the steamer Caroline, and accomfpanied by a quartet of musicians, the party, some 150 in number, wives, sweethearts and kiddies, left San Francisco at 9:15 a. m., arriving at the picnic grounds at 10:30.

Here the spacious pavilion was taken possession of and all the old-fashioned and modern light fantastics were indulged in by old and young, big and little, while here and there quiet little parties were enjoying an out-of-door dinner under the protecting branches of the old "buckeyes" with their sweet-smelling blooms. The big game was that of "indoor baseball," played in regular manner with full regulation indoor diamond, between the Contractors and Jobbers. The teams proved themselves to be an equal match, for despite the fancy touches, the in-curves of either side, and the encouragement of the fair fans under the careful and clever captaincy of C. A. Ross for the Contractors and W. L. Goodwin for the Jobbers, the score stood 5 to 5 at the conclusion of the third inning. Umpires—N. M. Hope on the home plate; R. T. Brown on bases.

The events of the day included:

100 Yard Dash for Men—1st prize, 1 pair of slippers, won by A. L. Capps, Pacific States Electric Company; 2d prize, 6 ft. zig-zag rule won by J. C. Williams, Holabird-Reynolds Co.

Young Ladies' Race—1st prize, tango collar, won by Miss M. Melharn; 2d prize, electric lamp, won by Miss A. McManus.

One Hundred Yard Race for Members Only—Prize, Perfume de L'Onion, won by C. S. Chamblin, California El. Con. Co

Fat Men's Race—1st Prize, 1 case wine, won by A. E. Drendell, Drendell Electric Co.; 2d prize, pair of pliers, won by W. L. Goodwin, Pacific States Electric Company.

Ladies Over 165 pounds—1st prize, gilded clock, won by Mrs. T. W. West; 2d prize, 1 doz. wine glasses, won by Mrs. A. L. Hughes.

Journeymen's Race—1st prize, hack saw frame, won by R. L. Booth; second prize, pair of pliers, won by H. Boynton.

Girls under 12, 50 yard dash—1st prize, glove order, won by Miss Irene Noblitt; 2d prize, box of candy, won by Miss B. Silverman.

Boys under 12—1st prize, telegraph outfit, won by Ross West; 2d prize, baseball outfit, won by Walter Ames.

Girls under 6—1st prize, box of candy, won by Miss Ruth Richmond; 2d prize, box of candy, won by Miss Margaret Hanbridge.

Boys under 6—1st prize, baseball outfit, won by Arthur Hughes, 2d prize, baseball outfit, won by A. Sedgwick.

Men's free-for-all—1 package of stimulants, won by A. L. Capps, Pacific States Electric Company.

Gate prize (ladies)—Mrs. A. T. Brown, portable lamp; Mrs. A. McDonald, glove order; Mrs. A. E. Drendell, pair of silk hose.

Gate prize (men)—E. W. Regensberger, slide rule; A. Leibes, box of cigars; A. L. Capps, Carroll hat.

Committees: Arrangements—Messrs. Boynton. Chamblin, Sittman, Hope, Hanbridge. Finance—Messrs. Hanbridge, Chamblin, Watts. Games—Messrs. Hope, Boynton, Reid, Smith, Regensberger, Hughes. Boosters—Messrs. Boynton, Ames, Decker, Gallivan, Fortini, Davis, Kirsten, L. Levy, P. C. Butte, Carlson. Entertainment—Messrs. Sittman, Kohlwey, McDonald, P. Levy, P. C. Butte.

Those participating in the outing were: C. W. Atkins, G. H. Battee, R. L. Booth, A. L. Boynton, wife and sons, A. T. Brown, wife and son, W. Burns, Miss A. Butler, P. C. Butte, C. C. Caben and wife, A. L. Capps and wife, C. Chamblin, A. H. Cobleigh, W. P. Collins, Mrs. W. K. Cooper E. A. Crowson, C. C. Davis, Miss B. Dooley, A. E. Drendell and wife, W. R. Dunbar, Miss C. Duncan, E. J. Dwyer, H. S. Engle, Mrs. M. J. Fleming, Miss Gibbs, R. W. Glenn. W. L. Goodwin, L. Grundy, W. B. Hall, W. S. Hanbridge, wife and daughter, D. Harris, J. A. Herr, M. E. Hickox and wife, Miss L. C. Hinkle, N. M. Hope and wife, (Pop) Hughes, wife and daughter, D. Hughes, wife and children, R. T. Kahn, W. J. Kline, W. Lacy, O. W. Lane, A. H. Larson, Mrs. L. Laws, A. Lickes and son, A. Meinema, Miss M. Melhorn, Miss A. McManus, T. H. McDonald, T. E. Morgan, W. L. Newlands, E. G Wilson and wife, A. V. Olson, M. S. Orrick, R. W. Otto, E. Parks, Miss Parks, R. B Petersen, Mrs. I. Pollmayer, F. Poss, N. D. Powell, H. C. Reed, F. W. Regensberger and wife, J. A. Richmond, wife and children, G. V. Ross, A. E. Rowe, M. L. Scobey and wife. M. W. Sellar, M. Steel, Miss Sweetman, W. Tardiff, E. M. Thick. H. Walk, A. W. Watson, Miss W. Weekly, T. W. West and wife, J. C. Williamson, Mrs. A. Willison, F. W. Wilson, H. Zweifel.



All Happy Despite the Rain.

NEWS NOTES

FINANCIAL.

VALDEZ, ALASKA,—The Alaska Water, Light & Power Company is increasing its capital stock from $100,000 to $250.000 S. A. Hemple, Valdez, is at the head of the company.

FRESNO, CAL.—The Tulare County Power Company, which was organized a year ago by the citizens of Lindsay, and has been generating power by steam and selling it to the residents of the county, is to issue $1,000,000 of 6 per cent bonds within the next few weeks. The moneys received from the sale of these securities is to be used in paying outstanding indebtedness, constructing and erecting main lines and extensions, adding to its steam plant and equipping the same and to purchase machinery to equip a hydroelectric generating plant on the Tule River. The bonds will run for a period of 25 years and will be secured by a mortgage on all of the property now owned or hereafter acquired by the company. The mortgage will provide for an annual sinking fund of $23,000.

SAN FRANCISCO, CAL.—The trustees of the Sloss interests have announced that no further advances will be made by them for the payment of the interest on the Northern Electric Railway Company first and consolidated 5 per cent 40 year gold bonds, or on any notes secured by said bonds, until such time as the situation warrants them in again considing this question. Coupons on all underlying bonds are being paid as they mature. The trustees are of the opinion that their primary duty in administering the trust, and particularly the fund deposited by Mrs. Sarah Sloss as a contingent assurance to creditors, is to employ the fund in safeguarding the properties with a view of protecting the principal, rather than to deplete such fund continually by advancing interest payments.

OAKLAND, CAL.—The directors of the Oakland, Antioch & Eastern Railway have announced an assessment of $5 per share on the capital stock of the company, payable as follows: $2, payable July 3; $1.50, payable October 1, and $1.50, payable January 1, 1915. President Arnstein reports excellent gross receipts for March, April and May despite adverse conditions as follows: March, $47,924.02; April, $48,591.21; May (last three days estimated), $53,000.00. In explaining the unusual procedure of making an assessment for capital improvements and additions, and not for deficits or loss, the directors say, that notwithstanding the fact that there are now $1,350,000 bonds in the treasury, authorized by the railroad commission, the largest stockholders have decided that as the future of the company looks so bright they would prefer to pay an assessment on their stock rather than endeavor to put these bonds out under the present unfavorable conditions and thus burdening the company with high interest charges.

ILLUMINATION.

NOGALES, ARIZ.—Monte Mansfield and Spiro S. Proto have been granted an electric light franchise.

AUBURN, WASH.—A 50 year franchise has been granted to J. L. Veach for installing a gas plant in this city.

LOS ANGELES, CAL.—Hermon district, located east of Pasadena avenue, is seeking a modern lighting system for that part of the city.

EUGENE, Ore.—The county court has granted a franchise to Richard Clow of Mapleton, Ore., to operate and maintain an electric lighting plant in that town, which is unincorporated.

VADER, WASH.—The Vader Gas & Fuel Company has secured a franchise to operate here. The franchise is granted for a period of twenty-five years, the city to receive street lighting without cost.

SAN BERNARDINO, CAL.—The project for a municipal electric light plant, plans for which have been under consideration for over a year, may be taken up shortly by the city administration. Local electric companies will be asked to name figures on their system, after which a bond election will be held.

BANNING, CAL.—The board of city trustees has sold a blanket franchise to Ghreist & Son, of Newport Beach, Cal., who will proceed to install an electric light and power plant in Banning. Electricity will be supplied by the Southern Sierra Power Company. Mr. Ghreist is planning to operate lighting plants at Victorville and elsewhere, Banning to be headquarters.

NEVADA CITY, CAL.—Washington, an old mining town on the South Yuba River, 19 miles above here, is soon to use electric lights. Henry O. Kohler and A. Schwartz, business men of that place, have had men employed for some time constructing a ditch and flume nearly five miles in length, which will bring water power to Washington, with which to generate electric power.

TRANSMISSION.

SANFORD, ARIZ.—Fire has destroyed the plant of the Gila Valley Light, Power & Water Company, only recently completed.

LOS ANGELES, CAL.—City Attorney and Acting Mayor Betkowski has decided on the disposition of $1,350,000 of power bonds at once, to be used to complete the city's power plant in San Francisquito Canyon.

BUCKLEY, WASH.—The business of the Buckley Electric Company has been acquired by the Puget Sound Traction, Light & Power Company who began service at that point May 1st. Under the new management the town will have 24 hr. service.

STOCKTON, CAL.—The Oro Development, the Oro Electric and the Oro Water, Light & Power Company held their annnal meetings last week. The only change in the directorate of the companies is the election of F. B. Peterson, a heavy stockholder, to succeed W. S. Wilsey, resigned.

LOS ANGELES, CAL.—The board of supervisors of Los Angeles county will receive bids up to July 6th, for the purchase of an electric transmission line and distribution system franchise along all public places, streets, lanes, highways, etc., in the county, the same to be maintained for 40 years.

EUGENE, ORE.—R. H. Clow, who has been granted the right to maintain and operate a power distributing system at Mapleton, is building a dam and power plant on the creek which flows through the city and proposes to sell electric power and lighting. The franchise was granted by the county court.

OREGON CITY, ORE.—The power plant being constructed by M. J. Lee of Canby, to supply the towns of Canby, Molalla, Needy and Mulino and the farming community in the southwestern part of the county is well under way. The weir dam on the Molalla River, about two miles above Molalla, has been built. The ditch and flume, totaling in distance about 1800 ft., have been completed. Mr. Lee has applied to the councils of Canby and of Molalla for franchises.

TRANSPORTATION.

SEATTLE, WASH.—The Seattle City Council recently granted the Puget Sound Traction, Light & Power Company a franchise to construct and operate a street railway extension on Ravenna Boulevard.

SAN FRANCISCO, CAL.—Definite action has been taken by the public utilities committee of the supervisors looking to the opening of negotiations for the purchase of the United Railroads properties by the city.

SEATTLE, WASH.—Application has been made by the Puget Sound Traction, Light & Power Company for a railway franchise on Avalon way from West Spokane street to the junction of West Alaska street and 29th avenue. The company will agree to common user clauses.

TUCSON, ARIZ.—The street railway will be extended from the present terminus at the gate of the university grounds north on Park avenue and east on Speedway, a distance of more than a mile. The right of way has been donated to the Rapid Transit Company for the extension.

SEATTLE, WASH.—The city council has voted to issue $500,000 in public utility bonds to be used with a like amount in general bonds recently authorized for building 8 miles of municipal car line through Rainier Valley. The route of the proposed line parallels the line of the Seattle, Renton & Southern.

STOCKTON, CAL.—The new Tidewater & Southern Railroad, operating between Stockton and Modesto, has put in commission its first 42 ton electric locomotive and the tryouts have proven most satisfactory, and the officials will announce shortly the regular running time of the machine, which is destined to handle all the freight carried over the road. The locomotive is equipped with four 65 h.p. 600 volt motors, connected in series of 1200 volt motors, connected in series of 1200 volts.

MILL VALLEY, CAL.—Ground has been broken in Cascade drive for the Mill Valley branch of the Marin County Electric Railways Company which proposes to build and operate a suburban system between this city and Sausalito as well as to give both terminal towns street car service throughout their lengths. All of the franchises have been secured for the road and more than 75 per cent of the stock has been subscribed. The road will be in operation before the opening of the Exposition, according to W. W. Hicks, who is back of the project.

OAKLAND, CAL.—The elimination of the old style of turning cars at the end of the runs is planned on the new "loop" system, for which the San Francisco-Oakland Terminal Railways has provided in its request for a $10,000,000 issue of bonds or improvements and the paying off of old debts. Heretofore cars on Broadway and Washington streets have gone to the ends of their runs and stopped, and the car crews have turned the trolleys and changed ends for the return trip. By an elaborate system of switches and turnouts, costing about $50,000, the cars hereafter will reach the ends of the lines, turn off for a block, go around the block and return to the original street.

TELEPHONE AND TELEGRAPH.

SAN FRANCISCO, CAL.—The Pacific Telephone & Telegraph Company has been granted a building permit for a class A substation at Commercial and Montgomery streets to cost $30,000

HOLTVILLE, CAL.—A. E. Wright of the Valley Telephone Company has petitioned for a franchise to operate a city telephone exchange here agreeing to expend not less than $3000 in the system immediately.

ASTORIA, ORE.—An ordinance was introduced at a recent session of the city council requiring the Pacific Telephone & Telegraph Company to place all its wires underground, when the streets are improved.

STEVENSON, WASH.—Application has been made by A. D. Davison, James Graves, E. C. Hamilton, Louis Aalvik and E. E. Shields for a franchise to build, equip, maintain and operate telephone lines over roads in Skamania county.

BRAWLEY, CAL.—R. Wigton, Commercial Engineer, of the Pacific Telephone & Telegraph Company is making a survey of opportunities for future business in Imperial valley, with recommendations for the extension of the telephone service.

NEWPORT, CAL.—The Pacific Telephone & Telegraph Company has been granted the privilege to erect poles, wires and other appliances and lay underground cables for the transmission of electricity in this city for telephone and telegraph purposes.

LA JOLLA, CAL.—The Pacific Telephone Company has signed a lease on a store in the Chase block and will move to the new location some time in June. A new switchboard and better accommodations for communication with San Diego will be installed.

STOCKTON, CAL.—The farmers in the section between Vernalis and Tracy have formed a co-parnership for the purpose of building a telephone line 32 miles in length connecting with Lathrop and Banta and with all the farmers' lines in this territory.

WOODLAND, CAL.—Bids will be received by the board of trustees up to June 22 for the sale of the franchise of the Pacific Telephone & Telegraph Company to maintain poles and to lay underground conduits for the transmission of electricity for telephone and telegraph purposes.

WATERWORKS.

FRIDAY HARBOR, WASH.—The contract for the construction of the water system has been awarded to Baker & McCrary for $4321.

NORTH POWDER, ORE.—Bids will be received until June 25th for the purchase of $20,000 worth of water bonds for the construction of water works.

MILWAUKEE, ORE.—The city council has received plans for laying an 8 in. pipe line from the Portland Bull Run water system to Milwaukee. It is estimated that the line will cost $20,000.

SNOHOMISH, Wash.—The council has adopted a resolution providing for the improvement of the city water system. The work will consist of excavating and laying 15,000 ft. of pipe with necessary connections and repairs on reservoir. The approximate cost is $19,060.

SANTA CRUZ, CAL.—Steps have been taken for the calling of a water bond election in the sum of $150,000, the money to be used in laying a new and short supply pipe line to Laguna Creek, pipe of 18 in. against the present 14 in. and the construction of the necessary storage reservoir.

RENO, NEV.—The Reno Power, Light & Water Company has been ordered by the Nevada Public Service Commission to begin the construction of a clarifying and sterilization plant for water furnished to Reno and Sparks from the Truckee River before July 1st and finish it within ninety days.

TACOMA, WASH.—The city has entered into a co-operative agreement with the forest service for the protection of the source of its water supply, the watershed of the Green River, which lies within the Rainier national forest. The two agencies working together will protect this stream from the results of forest destruction by fire or by other agencies.

RIVERBANK, CAL.—W. Hobart met recently with the business men of Hughson to discuss the installation of a water system at that place. The Hughson board of trade held a meeting and approved the plan and the work will cost $80,000 and will be owned by the Riverbank Water Company, but will be known locally as the Hughson Water System.

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BY C. E. GRUNSKY.

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JOURNAL OF ELECTRICITY
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THE MULTIPLE ARCH DAM OF REINFORCED CONCRETE

BY C. E. GRUNSKY.

(The use of reinforced concrete as a building material has made possible the construction of dams which do not depend upon massiveness for their stability. The multiple arch dam is one of the economical methods of construction thus made possible, and this discussion relates to the stresses in this type of structure and the principles which should be followed in its design.—The Editors.)



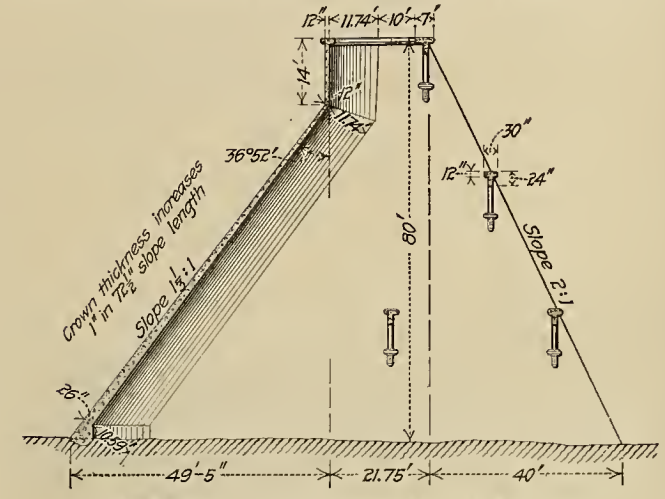
Rear View of Big Bear Valley Dam—This is an Eastwood Multiple Arched Dam, 92 ft. High and 363 ft. Long on the Crest.

The properties of concrete and its permanency as a building material becoming better known, its use is being extended. Combined with iron and steel, so distributed through its mass as to take up the tensile stresses that develop in any structure, it is no longer restricted to use under conditions that subject it to compressive strains only. Its successful use in floor construction and for pipe lines of large dimensions and under high pressure with relatively thin shells, points the way to new principles in the design of many structures.

Where, to withstand water pressure, it has in the past been customary to rely upon the massiveness of structures, the conviction is now irresistible that imperviousness could have been secured in many cases by lighter structures designed with due regard to the

stresses in all their parts. This statement has special application to the design of masonry dams at points where a suitable foundation can be secured.

In recent practice the types of dams which rely for imperviousness upon a comparatively thin membrane or deck, or skin of wood, iron or earth, closing against an impervious foundation and backed by more or less pervious material, are numerous. Concrete has been used but little as the sole reliance for facing high embankments of earth or rock mainly for the reason that concrete has but little elasticity and is, therefore, too prone to rupture under unequal settlement of the material used for its support or under the strains result-



Cross-Section of New Big Bear Valley Dam.

ing from temperature changes. These objections do not apply with the same force to reinforced concrete in which, under ordinary circumstances, there need be no cracking of a character that will menace the safety of a structure. It is reasonable, therefore, to use this material as a facing for rock fill dams.

The only questions to be considered are whether adequate support can be given to such a facing, whether a water tight connection can be made with bedrock and what thickness of concrete is necessary to secure imperviousness at various depths below the water surface.

Of these questions, those relating to the character of the foundation on which the concrete must rest and relating to the required thickness of the concrete deck or facing can be definitely answered on the basis of conditions at the dam site and experiments with the materials of which the concrete is to be made. The remaining question relating to the support of the facing is involved in some uncertainty.

It is evident that this uncertainty would be removed if masonry piers or buttresses were substituted for the loose rock, and this consideration has led to the design of hollow dams and also suggests the multiple arch form of dam.

Some years ago it required courage to advocate the thin shell of concrete that might thus be used as an arch between piers. Now that reinforced concrete may be substituted for plain concrete and the reliability of concrete as an impervious or nearly impervious material is better understood it is quite proper to treat a relatively thin shell of this material as impervious. Many dams have already been constructed on this principle.

Of the dams with a thin concrete face the multiple arch dam is particularly attractive for the reason that all material used in its construction can be brought into service under compressive stresses alone, and that these stresses are determinable with a high degree of accuracy. Rusting of the material used for reinforcement, in case there should be any rusting, will not destroy the stability of such a dam. The following general discussion relating to stresses in multiple arch dams will make clear the principles that should be followed in designing such a structure.

Stresses in Piers of Buttresses and Arches of a Multiple Arch Dam.

In order to obtain a clear conception of the strains in arch and pier of a multiple arch dam, let it first be assumed that such a dam be constructed of material having no weight. The arch may then be regarded as built up of a number of superimposed segments of cylindrical shells with definite thickness.

Let **H** represent the total height in feet; of a dam, to the water surface; **h** the average depth in feet of the ends of a unit increment of the arch below the water surface, that is, depth at the piers; **t** the thickness in feet of the arch unit increment whose abutments are at the depth **h**; **s** the allowable compressive strain in pounds per square inch of the material of which the dam is composed; $\mathbf{t^1}$ the thickness in feet of the pier at the face of the dam at the depth **h**; **R** the large or water face radius of the arch in feet and assume the construction such that the value of **R** is uniform for all depths; α the angle between the slope of the face of the same and a horizontal line; and **L** the distance betwen pier centers in feet.

In such hypothetical cases the thickness of the arch can, for all practical purposes, be determined from the equation:

$$144\,s\,t = 62.5\,h\,R \qquad (1)$$

$$t = \frac{62.5\,h\,R}{144\,s} \qquad (2)$$

Equation (2) is strictly correct for the multiple arch dam with vertical face. It is near enough to the truth for all face slopes likely to occur in practice. For arches with axes on a slope, the value of t thus determined will give some excess material at the crown, because the crown is then at less depth below the water surface than the corresponding arch abutment.

The direction of the water pressure on the successive arch rings is normal to the arch axis. The horizontal component of the pressure on any such ring is exactly equal at the pier to that of its neighbor. The component of the water pressure normal to the face of the dam is at right angles to the face line of the pier. Consequently, if the material of which the dam is constructed has no weight the pressure line in the pier will be a straight line normal to the face of the dam and the thickness of the pier at its upstream face will be at the depth **h**:

$$t^1 = \frac{62.5\,h\,L}{144\,s} \qquad (3)$$

For the special case when $\mathbf{R = L}$, that is, when the span of the arch is 60 degrees, there will be $\mathbf{t^1 = t}$.

In the assumed hypothetical case of masonry without weight, the line of thrust in the piers is normal to the general position of the face of the dam. The outside or downstream edge of the piers should make an angle of 90 degrees with the upstream face line of the pier. Consequently, if the dam has a water slope of $\alpha = 30$ degrees, the downstream edge of the piers would slope away at 60 degrees and if the water face slopes 45 degrees, the downstream edge of piers would also slope at 45 degrees and so on.

To determine the modification, if any, that must be made in the foregoing formulas, or the departures from values determined by them when the weight of the material of which the dam is constructed is taken into account, let it be supposed that by use of the formulas the dimensions of arches and piers have been determined. Unit sections of the pier and adjacent half arches at various depths are then considered as independent structural elements, each required to sustain the water pressure transmitted by the arches to the pier, and to sustain in addition thereto the weight of material. The dam, in other words, is assumed to be composed of a series of superimposed disconnected laminae, each of which extends through the pier and the half-arches, and has the dimension unity measured up and down the upstream face of the pier. The forces are to be diagramed on the assumption that the water pressure will just hold each such unit layer in equilibrium. The resulting pressure lines from the face of the pier down to the base of the dam will have positions for a dam with $\alpha = 60$ degrees, about as shown by the curved lines in Fig. 1. Their inclination is a safe guide to the inclination which should be given to the downstream face or edge of the pier. These lines, while aiding in determining the magnitude and direction of the maximum stresses that are possible in the pier, do not permit of absolutely correct deductions in these matters, because the laminae are not in reality disconnected and the excess weight at the top of the structure, due to requirements of construction and generally also due to the loading resulting from topping the dam with a roadway, would, if taken into account, bend the lines more sharply downward. However, with due regard to the spacing of these lines in the various portions of the pier, they become a guide to its required thickness and they have thus been used in designing the piers, shown on the accompanying diagrams. Each pier has been given two plane sides, so that the preparation of forms is made as simple as possible. There is no departure from the two side planes, except only at the top, where a minimum requirement of two feet in thickness has been assumed, and at the points where buttress supports are planned for inter-pier stiffening arches. In the diagrams lines of uniform pier thickness are shown. They appear as light, broken, parallel lines.



Front View of Big Bear Valley Dam—This dam was built during 1910-1911 at the same cost as for the old dam in the foreground, though the space closed is over one-third larger and the storage capacity three times greater. The new dam has a safety factor twice as great as the old one.

Reinforcement should be provided in both arches and piers in lines parallel with the water slope and as nearly at right angles thereto as practicable. The main purpose of the reinforcement will be to prevent temperature cracks. It is not taken into account in determining the required dimensions of arches or piers. All parts of arches and piers will theoretically be under compressive stress only.

According to the foregoing the formulas (2) and (3) are not strictly true, except only for the crown of

an arch with vertical axis. In practice they may be accepted with confidence, both for the determination of the thickness of the arch at any depth and the thickness of the pier at the water face line (i.e., as it would be if extended forward to the water face of the dam).

Special Case of a Dam 200 Feet High.

By trials not necessary to describe in detail the desirable slope of the water face was found to be about 60 degrees. The top of the dam is supposed to carry a roadway 20 ft. wide at an elevation 6 ft. above the water surface. On this roadway two parapets 4 ft. high are assumed. The upper 22 ft. of the water face

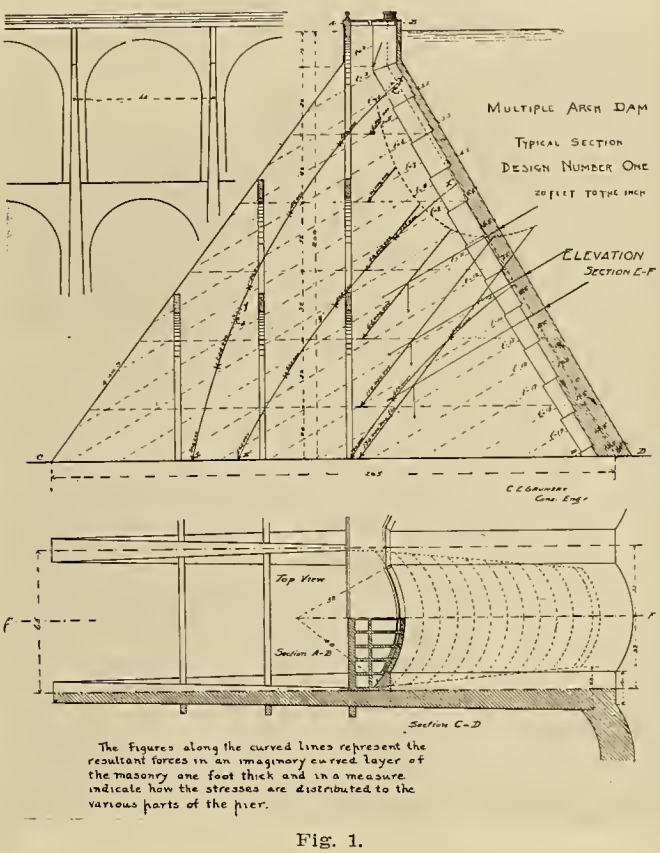


Fig. 1.

is to be vertical. The minimum thickness of arch and pier masonry is to be 2 ft.

The roadway is supposed, for strain sheet purposes, to be constructed of reinforced concrete, it being assumed that the upper series of stiffening arches between piers, the roadway and the supports and the parapets will be equivalent to an addition of 70 cu. ft. of concrete per lin. ft.

As shown in the sketch, the piers are to be interconnected at about one-third and at about two-thirds of the maximum height of the structure by three sets of stiffening arches 3 ft. thick with 8 ft. depth at the crown. The exact spacing of these arches is to be determined when the structure is located on the ground.

At the deepest point of the stream-bed the slope of the face is to terminate at about the surface of the ground and below that elevation the axis of the arches is to be vertical. In computing strains in the piers the vertical position of this sub-surface section of the structure is disregarded because the same will have adequate support against downstream movement by the natural material or back-fill against which it rests.

The aggregate amount of material in the piers (except for irregularities in the foundation) is independent of their spacing. The distance between pier centers may, therefore, be determined with a view to keeping the masonry in the arches at minimum figures, or to securing especially favorable locations for one or more piers, or finally to keep down the number of piers whereby the cost of preparing the foundation may be reduced.

For the same value of **R** and the same slope of the face, the quantities of material per linear foot of dam in arches spanning 60 degrees, 120 degrees and 180 degrees, are to each other as 1 to 1.15 to 1.50.

It is interesting to note in this connection that for a given spacing between piers, and material of construction such that any thickness of arch is allowable, the quantities of material per linear foot of arch for the 60 degrees, 120 degrees and 180 degrees arches would be to each other as 1.45 to 1.00 to 1.15. But the thickness of the arch when determined solely from economy of material and on arbitrary pier spacing is not acceptable. The thickness should not be determined without due regard to the requirement of imperviousness. When its thickness at various depths on this latter basis has been determined, a proper application of the allowable stress of compression will give the value of **R**. The adoption of the economical arc of about 60 degrees will then make the pier spacing about equal to this radius of curvature.

In the absence of data based on experience, but with the knowledge that well made concrete in reinforced pipes with 6 to 10 in. shell thickness is in use under pressure up to 80 ft., it appears that comparatively thin arches could be used with safety. But concrete is a material which by nature of its production may lack homogeneity. In structures of such importance and magnitude as a high dam, it should always be used with a reasonable factor of safety.

With this in view, to meet fully the requirement of imperviousness, it is believed that the concrete in the arches should have a thickness at least equal to one-twentieth of the depth below the water surface.

As it is quite possible that it may be found desirable to prescribe even a greater factor of safety for a dam 200 ft. high against leakage through the masonry than indicated by this formula ($t = \frac{h}{20}$) the dam, Fig 1, has been planned with an arch thickness everywhere at least equal to one-sixteenth of the depth below the water surface.

For $h = 192$ and $t = 12.5$ and a value of $s = 330$ lb. per sq. in., the value of **R** and consequently, the pier spacing will be about 50 ft.

A first tentative design for a dam about 200 ft. high was, therefore, made with 50 ft. between center lines of the piers and with the outer or large radius of the arches 50 ft.

While these dimensions, and particularly the thickness of the arches are tentative, they are in accord with sound engineering practice and, if in the final design any change is made, it will be in the direction of a reduction of the proposed thickness of the arches with corresponding decrease in the arch radius.

It may be repeated that the perviousness of concrete will be the principal factor to be considered in this connection and that before reaching final conclusions relating to minimum allowable arch thickness, some experimental data with the particular materials that are to enter into the composition of the concrete may have to be secured.

Whether the piers should not be spaced further apart than 50 ft. has been given consideration. Wide spacing is desirable because thereby the number of piers is reduced and the work of excavating for foundations is somewhat simplified. But there is no saving in masonry as a result of wider spacing. It is therefore, questionable whether the advantage of fewer piers off-sets the disadvantages of the longer arch spans. The longer the arch the greater will be the departure from straight line work, which is of importance as it simplified the closing against bedrock. The masonry in the arches, too, will increase the quantity either with R at 50 ft. and a relatively longer arch, or with a larger radius and a corresponding increase of the thickness of the arch.

On the typical design, Fig. 1, as a result of giving weight to these considerations, a pier spacing of 66 ft. between centers has been assumed for a dam 200 ft. high. The upstream face of the arch will cover a span of 60 degrees, if the upstream face of the piers between arches is made 16 ft. By adopting some such scheme as keeping the upstream pier face of uniform width from top to bottom, a uniformity of forms will be secured for each unit of the upstream face of the dam that will facilitate construction.

The downstream or concave surfaces of the arches may be treated as a section cut out of the surface of a cone frustum, the radius of curvature gradually decreasing from top to bottom, or the thickness of the arches may be made uniform throughout successive depth increments of selected magnitude. In the typical design, Fig. 1, there is an increase of thickness shown at each additional 16 ft. below water surface.

In the design No. 2 (Fig. 2) there is a gradual increase of thickness from the minimum, 2 ft. at 16 ft. below the water surface, to 13.5 ft. at 200 ft.

The arch thickness for $R = 50$ ft., will be as follows, under the offset plan of design No. 1.

Arch thickness for $R = 50$ ft.

Top of dam to	16 ft.	below water surface,	2 ft.
16 ft. to	32 ft.	below water surface,	2.5 ft.
32 ft. to	48 ft.	below water surface,	3.5 ft.
48 ft. to	64 ft.	below water surface,	4.5 ft.
64 ft. to	80 ft.	below water surface,	5.5 ft.
80 ft. to	96 ft.	below water surface,	6.5 ft.
96 ft. to	112 ft.	below water surface,	7.5 ft.
112 ft. to	128 ft.	below water surface,	8.5 ft.
128 ft. to	144 ft.,	below water surface,	9.5 ft.
144 ft. to	160 ft.	below water surface,	10.5 ft.
160 ft. to	176 ft.	below water surface,	11.5 ft.
176 ft. to	192 ft.	below water surface,	12.5 ft.
192 ft. to	200 ft.	below water surface,	13.5 ft.

These dimensions are based on an allowable compressive stress in the concrete of 330 lb. per sq. in. and no account is taken of the added strength due to the reinforcing steel.

The thickness of the piers as they result from an interpretation of the strain diagrams for a pier spacing 66 ft. between centers and $R = 50$ ft. would be as follows:

Thickness of Piers at Water Face Line.

16 ft.	below water	surface	3 ft.
32 ft.	below water	surface	4 ft.
48 ft.	below water	surface	5 ft.
64 ft.	below water	surface	6 ft.
80 ft.	below water	surface	7 ft.
96 ft.	below water	surface	8 ft.
112 ft.	below water	surface	9 ft.
128 ft.	below water	surface	10 ft.
144 ft.	below water	surface	11 ft.
160 ft.	below water	surface	12 ft.
176 ft.	below water	surface	13 ft.
192 ft.	below water	surface	14 ft.
200 ft.	below water	surface	15 ft.

From these points at right angles back from the face line of the piers the thickness of the piers should be uniform.

The downstream edge of the pier is to have a slope of 4 on 3.

Based on the dimensions here indicated, but without allowance for the masonry required to close against bedrock or to properly transmit strains to bedrock, or to extend cut off curtains into bedrock, the concrete required will be about as follows:

Contents in cu. ft. per lin. ft. where $R = 50$ ft. $L = 50$ ft., $s = 330$ lb. per sq. in. and $\alpha = 60$.

Contents in Cubic Feet per Linear Foot.

Height to water surface.	Contents.	Height to water surface.	Contents.
16 ft.	125 cu. ft.	128 ft.	2170 cu. ft.
32 ft.	215 cu. ft.	144 ft.	2890 cu. ft.
48 ft.	350 cu. ft.	160 ft.	3660 cu. ft.
64 ft.	550 cu. ft.	176 ft.	4550 cu. ft.
80 ft.	840 cu. ft.	192 ft.	5580 cu. ft.
96 ft.	1200 cu. ft.	200 ft.	6150 cu. ft.
112 ft.	1630 cu. ft.		

These estimates of quantities were made for a pier spacing of 66 ft. (Fig. 1), but are substantially correct, too, for a pier spacing of 50 ft.

The design, Fig. 1, was made with a water face radius of 50 ft. and a pier spacing of 66 ft. The allowable compressive stress of concrete was taken at 330 lb. per sq. in. Both surface of the arches in this design are cylindrical, the concave surface being offset where the arch thickness changes.

After the design shown in Fig. 1 had been made, further study indicated that a dam with a somewhat steeper face than 60 degrees with the horizontal would require a little less masonry. This led to the preparation of a design with the upstream face sloping two on one or $\alpha = 63$ deg. 26 min.

The pier spacing in this design, Fig. 2, was made 60 ft. between centers, the upstream face of the arches was given a radius of 44 ft. and the allowable compressive stress of concrete was taken at 300 lb. per sq. in. In this design the concave surface of each arch is shown conical.

Although the factor of safety is 10 per cent higher for design No. 2 than for design No. 1, the steeper slope of the upstream face and some minor modifications of the pier design more than offset the greater quantity of masonry that results from the use of the low allowance for compressive stress. Consequently, the cubical contents for dams of various heights, exclusive of masonry in footings, or masonry required to key the structure to bedrock at an allowable stress of 300 lb. per sq. in. should be somewhat lower than has been estimated for the design shown in Fig. 1.

Cubical contents for the second design, Fig. 2, in cubic feet per linear foot of dam:

Contents in Cubic Feet per Linear Foot.

Height to water surface.	Contents.	Height to water surface.	Contents.
16 ft.	130 cu. ft.	128 ft.	2020 cu. ft.
32 ft.	200 cu. ft.	144 ft.	2670 cu. ft.
48 ft.	320 cu. ft.	160 ft.	3380 cu. ft.
64 ft.	480 cu. ft.	176 ft.	4220 cu. ft.
80 ft.	760 cu. ft.	192 ft.	5180 cu. ft.
96 ft.	1110 cu. ft.	200 ft.	5740 cu. ft.
112 ft.	1510 cu. ft.		

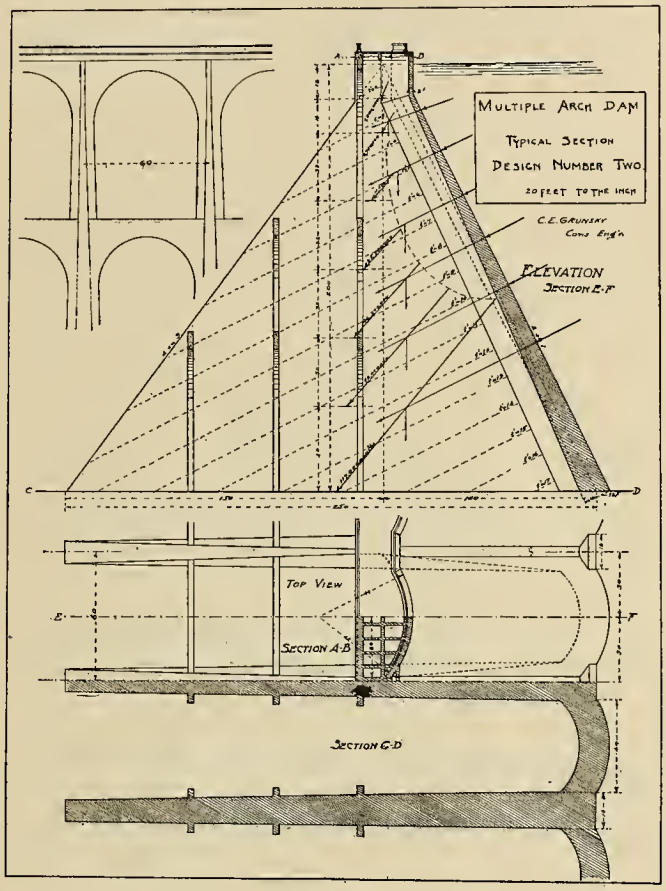


Fig. 2.

(Fig. 2. Curved lines X Y Z and X¹ Y¹ Z' indicate the positions of slices or layers of concrete in equilibrium, if regarded apart from the rest of the structure, one foot thick at the water face (at points X and X¹. The figures denote pounds of pressure, in approximate values, at the points where noted, for unit layers, which are assumed to extend from a vertical plane passing through the axis of one arch to the vertical axial plane of a neighboring arch. Each layer, therefore, represents two half slices of adjoining arches and a slice of the intermediate pier. If the space on the water face between the points X and X¹ be assumed to be thus subdivided into one foot layers and each slice from X toward Y is gradually increased or decreased in thickness according to whether the successive pressure lines X Y Z, X¹ Y¹ Z¹ etc., separate from or approach each other, and the space between two successive pressure lines at any point, as at Y, be called d, then the relation between pier thicknesses at A and at B can be preliminarily approximated from the equation

$$t^{11} = \frac{t^1 p^1}{d\ p}$$

where t^{11} is the pier thickness at Y; t^1 is the pier thickness at X; p_1 is the pressure to he cared for at Y and p is the pressure to be cared for at X. In the design shown in Figs. 1 and 2, the shape of the pier was determined from the allowable stresses at its base; a minimum pier thickness of 2 ft. at the top, and from the requirements that the piers have unbroken flat sides. The dimensions as shown would provide a larger safety factor for points near the top than near the base of the structure.)

The total forces resulting in each pier from a combination of the water pressure and the weight of masonry are shown in each design at various horizontal planes.

It has been assumed that a driveway will be required on top of the dam. When this is not required, minor modifications of the diagram will result.

The typical dam above described, illustrated in designs, Figs. 1 and 2, has been dimensioned, as stated, on the assumption that compressive stresses are not to exceed 330 lb. per sq. in. in the first design, nor 300 lb. in the second. This may, by some engineers, be considered a severe requirement, as concrete is frequently used in important structures under compressive stresses as high as 600 lb. per sq. in.

The United States Reclamation Service allows a compressive stress of 600 lb. per sq. in. in reinforced concrete. Dams of the Ambursen (hollow concrete) type are being designed and built with an allowed compressive stress of 600 lb. as, for example, the dam recently completed across La Prele River, 15 miles west of Douglas, Wyoming, which has a maximum height of 135 ft.

A recent design of an "all true arch" concrete dam 50 ft. high for the Aqua Pura Company in New Mexico, by Metcalf & Eddy of Boston, is based on an allowable compressive stress of 350 lb. per sq. in. and the possibility is indicated that, when raised to 95 ft. the compressive stress might, under certain conditions, reach 315 lb. per sq. in.

In other words, the designs of the Multiple Arch Dam here presented are based on a relatively higher factor of safety than is frequently prescribed, and any excess in this factor of safety, above the factor in common use is purely a safeguard against such indeterminate conditions as prevail during earthquakes.

Should it be determined that compressive stresses up to 400, 500 or 600 lb. are sufficiently conservative, in view, perhaps, of the increased strength resulting from the reinforced steel, then modifications can be made in the suggested dimensions which will materially reduce the total concrete required.

Before determining the allowable maximum stress for any structure of magnitude, experiments with the materials to be used, entering into the composition of the concrete, should be made. It is probable that with a compressive stress of only 400 lb. the factor of safety will be six to ten, while with 600 lb. it would be three to five, plus any additions that may be made for the added strength of the reinforcement steel.

The inter-pier stiffening arches and their buttress-like supports shown in the designs, are not planned to add strength to the dam against water pressure, but are, like the reinforcing steel and a high factor of safety, a safeguard against damage by such indeterminate forces as may be acting on the structure during earthquakes.

Points of Merit.

No part of the dam will be subjected to other than compressive stress. Internal hydrostatic pressure can be rendered impossible by a system of drainage.

All points of both sides of the arches can be made accessible without extensive excavation, so that if any leak around the concrete through defective bedrock should occur, the leak can be traced from the downstream side of the arches without emptying the reservoir, and not until the work of stopping such leak shows it to be necessary, need the reservoir be emptied.

The structure has all the flexibility required to adjust itself in all parts to expansion and compression, resulting from temperature changes and from hydrostatic pressure.

During construction the water of the tributary watershed can be passed through one or more openings left in the masonry of the arches, which need not be closed until the dam has otherwise been completed. Risk of damage by high water during construction is thus eliminated. The structure by reason of maximum elasticity obtainable with the materials used in its construction will have sufficient flexibility to be classed as possessing a maximum degree of safety against damage by the tremors of earthquakes.

The reinforcement which has been prescribed is not necessary to met the static stresses resulting from water pressure and weight of masonry, but is provided as a safeguard against damage by temperature changes and earthquake stresses.

The factor of safety can be selected with a degree of certainty rarely possible in any other type of structure of equal magnitude.

The foundations on which the piers rest should receive only a safe load, this being regulated by width of footings.

It remains to be said that the Multiple Arch Dam is not adaptable to every dam site. This type of dam can come under consideration only where the foundation is suitable, where it is possible to cut off subsurface flow of water by means of a comparatively thin curtain wall, and where there is good support for the piers. The dam is out of consideration when the dam site is in a narrow-canyon which can readily be closed by a single span arch. It is best suited to localities where the bedrock is massive and hard and where the strength of the dam is more than three times its greatest height.

UNDERGROUND HOISTING AND COMPRESSOR STATION.

There was recently placed in operation by the Silver King Coalition Mines Company, whose mines are located at Park City, Utah, what is perhaps the largest and most unique underground hoisting and compressor station in the world. It is located 1670 ft. below the surface and has been made possible only through the fact that its entire equipment is electrically operated.

This underground station has been installed to provide hoisting and compressed air service for a new shaft on the Silver King Mine from which shaft some of the ore bodies of this company's property can be worked more advantageously.

The station contains three rooms or chambers, occupying a floor space of approximately 3600 sq. ft. The walls and roof are of heavily reinforced concrete finished in smooth white cement plaster. The air for the shaft and construction of the station has been supplied by three large compressors from the surface. A motor driven compressor on the Sullivan W.-J.-3 angle compound type has been installed which supplies air for the station and shaft and serves as a booster on the main pipe line, this compressor having a capacity of 900 cu. ft. of free air per minute.

The motor driven hoist for operating the cages in this shaft is located in one of the three rooms of the station and is operated by 600 volts d.c. from a 250 k.v.a. synchronous motor—generator set also located in the underground sub-station, which obtains its power from the surface transmission lines through a 2200 volt cable.

The engineers in designing this plant have arranged it so that the air compressor which is used as a booster to the main air lines utilizes the electric current during the intervals when the hoist is not running, thus eliminating the peak loads which would be occasioned by the super-imposition of the demands of the two machines, and which would materially increase the price paid for electric power.

FACTORY SAFETY SUGGESTIONS.

In response to a general request from the employers of California for suggestions which will enable them to guard machinery so as to prevent accidents, the Industrial Accident Commission has issued a brief statement covering certain fundamental requirements relative to safety as observed in other states and in foreign countries.

Belts and Pulleys.

Belts and pulleys should be so located, wherever possible, as not to be dangerous to employes, or should be properly enclosed, fenced or otherwise protected. In all cases the point, if exposed to contact, should be guarded where the belt, rope or chain runs on the pulley, sheave or sprocket.

Guard all horizontal belts, ropes or chains driving machinery or shafting, 7 ft. or less from the floor, ley, sheave or sprocket.

In guarding overhead belts or rope drives, unless so guarded that persons cannot pass under them, the width of the guard should not be less than the width of the belt or rope drive and the length should not be less than the distance between the outer faces of the two pulleys. It should cover outer faces of the two pulleys or sheaves and extend upward to such a point, and be attached in such a way that in case the belt breaks, it will withstand the whipping force of the belt.

In rooms, or parts of rooms used exclusively for transmission machinery, such as the ground floor of saw mills and the basements of paper mills or flour mills, it has been found practical to define certain passageways for the use of oilers and millwrights and to guard the pulleys, belts and shafts along these passageways.

All loose pulleys should be furnished with a permanent belt shifter, so located as to be within easy reach of the operator. The belt shifter should be so constructed as to make it impossible for the belt to creep from the loose pulley back on the tight pulley. All belt shifters should be equipped with a lock or other efficient device to prevent the shifter from being accidentally shifted.

Pulleys should be so placed as to allow the width of the belt between two pulleys, or between the pulley and the shaft hanger, or a hook should be provided, or a guard placed adjacent to the pulley to prevent the belt from leaving the pulley.

Set Screws.

All set screws on moving parts, where exposed to contact, should be countersunk or protected by a solid collar, or a headless set screw should be used. No part of the screws should project above the surface.

Shafting.

All revolving shafting less than 7 ft. above the floor lines should be boxed or railed off, as revolving shafting is always a menace to those whose clothing might come in contact with it.

Projecting keys in shafting should be guarded or cut off.

In rooms, or parts of rooms used exclusively for transmission machinery, such as the ground floor of saw mills and the basements of paper mills or flour mills, it has been found practical to define certain passageways for the use of oilers and millwrights and to guard the pulleys, belts and shafts along these passageways.

Gears.

All gears, where exposed to contact, should be entirely enclosed or equipped with a flange guard which will enclose the teeth of the gears. On large gears, such as those on heavy shears and punches, the guard should be such as to cover them to a height of 7 ft. above the floor.

Where it is impracticable to cover the gears, a boxed frame of metal or wood should be installed, completely shutting off the machinery gears. It is necessary that all guards should be kept in place except when the machinery is shut off for repairs.

Grinding Wheels, Hoods and Guards.

Wheels should be handled with the greatest care in unpacking, storing, delivering, etc., and should never be left standing on the ground or wet places.

Great care should be used in mounting wheels; never force a wheel on the arbor. It is advisable to use relieved flanges, compressible washers between wheel and flange, and to obtain a perfect bearing at the outer edge of the flange. Vibration should be avoided at all times.

A protective hood, or guard, should be provided, wherever practicable, and the nut on the end of the arbor should be guarded. Cast iron hoods should be avoided as they have often been known to break when struck by a bursting wheel. The guard should be adjusted close to the wheel and extended over the top of the wheel to a point thirty degrees beyond a vertical line drawn through the center of the wheel. Wheels used for wet grinding should not be left partly immersed in the water.

Foremen should examine every emery wheel each day and see that the bearings are tight and well oiled, and that it is operated within proper speed limits, and is safe in every way.

The revolutions per minute at which wheels are run is dependent on conditions and in actual practice. Wheels are run at surface speeds of from 4000 to 6000 ft. per min. up to as high as 7500. It is recommended that for most grinding operations surface speeds should not exceed 6000 ft. As a wheel wears down the speed is increased to maintain the same surface speed and great care must be exercised when new wheel is provided to avoid over speeding.

TABLE OF GRINDING WHEEL SPEEDS.

Table of Grinding Wheel Speeds.

Diameter of wheel. In.	Rev. per Min. for surface. Speed of 4000 ft.	Rev. per Min. for surface. Speed of 5000 ft.	Rev. per Min. for surface. Speed of 6000 ft.
1	15279	19099	22918
2	7639	9549	11459
3	5093	6366	7639
4	3820	4775	5730
5	3056	3820	4584
6	2546	3183	3820
7	2183	2728	3274
8	1910	2387	2865
10	1528	1910	2292
12	1273	1592	1910
14	1091	1364	1637
16	955	1194	1432
18	849	1061	1273
20	764	955	1146
22	694	868	1042
24	637	796	955
26	586	733	879
28	546	683	819
30	509	637	764
32	477	596	716
34	449	561	674
36	424	531	637

Ladders.

Ladders should, wherever possible, be stationary; if movable, they should be provided with either sharp points at the foot, or wide, rough surface feet so as to prevent slipping. Ladders for use in oiling overhead shafting, where necessary to rest same on the shafting, should be arranged to hook over said shafting.

Stairways.

Stairways should not be built of a sharper angle than fifty degrees. For over fifty degrees, ladders should be used instead. All stairways should be equipped with hand rails. Where the stairway is not built next to a wall or partition, rails should be placed on both sides.

Platforms and Runways.

All elevated walks, runways or platforms, except on loading or unloading side of platforms, if four feet or more from floor level, should be provided with a guard rail. A toe board should be provided to prevent material from falling off.

Passageways—Keep Clear.

All passageways and gangways should be kept smooth and in good repair and free from nails or obstructions over which persons may stumble and fall.

Swinging Doors—Windows.

All swinging doors in stairways and all doors swinging both ways in general passageways should be provided with windows. One window should be provided for each section of double swinging doors. Both sides of the doors should be provided with adequate light, either natural or artificial, during the hours of active operation in the department in which said swinging doors are located. The windows must be kept free from dirt or other obstruction to the vision.

In order to accommodate boys or girls, the bottom of the windows should not be more than 48 in. from the floor. The size of the window which is recommended should be not less than 8 in. by 24 in. Guards should be placed over the window to protect the glass from being broken by protruding parts on trucks, etc.

SELLING ELECTRIC SERVICE

REQUIREMENTS FOR SUCCESS IN SELLING.

BY R. I. CARRUTHERS.

(From a paper presented recently at a meeting of salesmen of the Southern California Edison Company.—The Editors.)

Mr. J. H. Pieper's suggestion "Respect your competitor and show him ordinary courtesy," is one which is bound to gain for you the respect and confidence of your prospective customer. You must remember that the purpose of your competitor is the same as your own, a livelihood. Possibly his goods are not of the same quality as yours, nevertheless he is entitled to a square deal.

To be a good salesman is to be a dictator. The real salesman is the man who brings buyer and seller together. His services are most essential in the commercial world. He is the one whose efforts result in income.

A successful salesman must believe in his firm and, also, in the goods he has to sell. He must have confidence in and study himself as well as his customer. He must try to get his man interested to a point where he will ask questions, then his knowledge on the subject and his enthusiasm will gain confidence and an order will soon be forthcoming. To me the essential qualification of a successful salesman is honesty. He should be careful not to overestimate his goods or make any promises that his company will not back up. If he is honest he will not get in bad with his customer or his company.

The salesman must be a man of resource. He must know how to overcome objections which may be raised. In other words, he must be prepared to meet all conditions.

We all have our difficulties in getting business. Sometime ago I called on a competitor's customer who had taken a new store, and as we had secured the business in the building before, I was most anxious to obtain his application. My request for an interview was promptly refused, with the statement that his business relations with the other company had been satisfactory and he would continue with them in any location he might have.

As I turned to leave, a saying of Orison Swett Marden flashed across my mind, "I will find a way or make one." After thinking over the matter, I went to a telephone and called my prospect. He informed me that it was useless to take his time and mine as he had definitely decided to continue with the other company. I still persisted and succeeded in making an engagement for the next day, when his objections were overcome and his business secured.

The fundamental principles of successful business are system and organization. Were it not for these two principles it would be impossible for a company to meet the requirements demanded of them. Each department of the company must have its system and organization, under the supervision of a department head, whose duty it is to simplify the system and make it efficient.

These two principles, system and organization, are most necessary in the sales department. The first, to keep in close touch with prospective customers and see that all orders and applications are carried out with expedition. To accomplish this, co-operation is most essential among salesmen themselves. We must meet one another on equal grounds and, if neccessary, be willing to lay aside personal advantage, where doing so would be for the best interest of the company. It is not possible for a man to harbor petty jealousies and be true to himself or the company he represents.

Heads of departments must co-operate, not only to increase the efficiency of their own departments, but the company's service as well. It is my opinion that this co-operation should not be done in a haphazard way. I have known of cases where concerns have lost valuable business because of loose methods. In my judgment it is not wise for the head of one department to exercise control over the men of another department while the motives used may be the very best, sometimes the results are far from satisfactory.

Each salesman must have a system and organizaation by which he obtains best results. A salesman can organize his well satisfied customers into a sales department of his own. His aim should be to gain the respect and confidence of these patrons, thereby creating for himself an advertising medium of inestimable value. A well satisfied customer will do as much talking as a dissatisfied one. It has been my experience that well satisfied customers have been able to reach and obtain applications for me that I would not have been able to obtain myself.

It is a well known fact that private corporations have been much more successful and have established a greater degree of efficiency than municipally owned concerns. The reason for this is that private corporations have a well defined policy which they rigorously carry out and improve from year to year while with the other the policy changes with every political change in the city. We have a good example of this in one place where the municipal plant has been able to exist only because of radical legislation favoring it as against the commercial company.

In order that a company may carry out its own well defined business policy, not only for the present but also in the future it is absolutely necessary for each department to have and maintain its own smooth working organization. A broken cog in the smallest wheel in a watch or one dry bearing in a factory line-shaft may finally hinder the whole works.

A man must not be satisfied with his day's work, simply because he has turned in three or four applications, but must strive to keep a list of live prospects some of which are maturing every day.

A company appreciates its salesmen and will take care of them if they are good producers.

Electric smelting has been economically demonstrated for production of ferro-tungsten at a cost of 3.46 kw.-hr. per lb. and it is claimed for the Johnson electric furace for the treatment of zinc ores that a power consumption of 3.1 to 4.5 kw.-hr. will produce a pound of spelter.

THE THREE TYPES OF MANAGEMENT.

BY E. ST. ELMO LEWIS.

(This is the second of a series of three articles on Management by Mr. Lewis, who is President Detroit Executive's Club and advertising manager Burroughs Adding Machine Company. The first article in this series appeared in this Journal for May 30, 1914.—The Editors.)

Systematic Management.

System is the rut in which some men are proud to live, and one in which the thoughtless stay without fear of serious catastrophe.

System at its worst, affords the incompetent and indifferent a nice comfortable, easy way of doing things. They progress along the road that has already been marked for them, beaten down and rut-plowed by the wheels of a progress gone before. Automatically, every New Year's Day, salaries are increased a few dollars a week, to the automaton as well as to the thoughtful worker.

By the management each is checked up, and if he has followed the system, he is ignored, but if not, he is called down. Each has learned a set, prescribed way of going through his work until, as the youngster said, "he could play the piano with his eyes shut." Under a systematic management a man doesn't have to think, but he does something and remembers.

A great many go through their work just as they eat their meals. They eat them whether they want them or not. So they do their work whether it is useful or not.

When the President's Efficiency Commission investigated the government department at Washington, it found that government workers were making copies of original documents laboriously by hand. By the introduction of a photographic process of making these copies, a 75 per cent saving of clerical time and 90 per cent in cost was effected; $242,000 a year was saved in the handling of public documents. It was estimated that another $850,000 could be saved annually if the departments would properly standardize the handling and filing of correspondence.

The same discovery applies to the majority of business houses. Each department stands alone. To all intents it is separate business. This department files correspondence one way, this one has another that one still another. If four or five departments have correspondence with the same customer, or prospect, even about the same thing, it is only rarely that the complete correspondence can be brought together without a very great deal of difficulty and trial. Why? Is it not because the management does not see the business as a whole, however thorough may be its grasp of details?

The systematic type of manager is a decided improvement on the rule-of-thumb type. The systematic type recognizes that there are some better methods of getting information about what is going on. He aims to find what is a good way to do things by comparing the results of the good, bad, and indifferent methods of the past. He is making the first step toward finding out the facts about his business. The systematic type of manager has one drawback which is so common as to be almost universal—he is still thinking about things and not about people. To him a system is a chart of accounts, or a bunch of cards, or a vertical file, or a loose-leaf ledger with its accompaniment of books and forms and ideas about their handling, but still it leaves out the human element. He continues to believe that the man element is the uncertain, the unsystematic, the untrainable element. He does not think about the training of men but simply forces them into the grooves of handling a thing in a so-called systematic fashion. He makes them what he thinks they are—automatons.

System is on the contrary, a mechanical means to a humanizing end. Its primary purpose is to raise efficiency, and a system that doesn't raise efficiency is fallible, weak, impotent, in the way and a nuisance.

The purpose of a system is:

To keep a true record of what has actually happened.

To keep this record in such terms that the manager may readily translate it into the most productive action.

To insure a reliable, immediate, and accurate record, in order that the manager may determine standards relative to the practice of work, and the conditions surrounding the work, and the operation and their sequence, and fix an adequate reward for the best work.

In the highly systematized type of management the man gets caught in the net of a pre-determined method of following the work, and can make no change from it, without dislocating the whole business routine.

How often have you heard when you go into a retail store and you ask them to do something—"Well, we have never done it that way?" I once made a purchase of some hundred odd dollars in a jewelry store and asked them to deliver the purchase to a steamer. The clerk said that "The delivery doesn't go out until three o'clock." I had to have it delivered at two. In his routine way of thinking it never occurred to the clerk that he could have a special messenger do the delivering and even the head salesman had to "see if it could be done."

Harrington Emerson tells the story of a systematic government official. When he was living in Germany, there were only four official religions — Reformed, Lutheran, Catholic and Jewish. When Mr. Emerson was filling out the census blank for his father's family, he told the census official he wasn't a member of either of these four faiths, but he was told that he had to choose one of them or else be fined. Of course he chose.

In a business with which I was at one time connected there was a certain chart of accounts arranged, and you had to select which of these accounts a disbursement was to be charged. New conditions arose, but the chart of accounts remained the same. Items, for instance, such as were used for the development of the sales organization were charged to advertising accounts, and the management of the company, therefore, got an entirely erroneous idea of the amount of money it was spending for advertising. Nearly a sixth of the amount of money charged to the advertising accounts never even remotely affected the state of mind of the prospective purchaser. The consequence was that the chart of accounts ran the business, and not the business the chart of accounts.

The systematic type of mind constantly falls back for precedent—it is traditional. H. G. Wells, in his thought-provoking book, "The Discovery of the Future" hits off this type of mind remarkably well.

The systematic type of mind:

One might speak of as the legal or submissive type of mind, because the business, the practice, and the training of a lawyer disposes him toward it; he of all men must adhere constantly to the law made, the right established, the precedent set, and consistently ignore or condemn the thing that is only seeking to establish itself.

The efficient type of mind:

I might for contrast call the legislative organizing, or masterful type, because it is perpetually attacking and altering the established order of things, perpetually falling away from respect for what the past has given us. It sees the world as one great workshop and the present is no more than material for the future, for the thing that is yet destined to be. It is in the active mood of thought, while the former is in the passive; it is the mind of youth, it is the mind more manifest among the western nations, while the former is the mind of age, the mind of the "Oriental."

Now, the important thing in management is to realize that we need the strenuous, we need the systematic, and we need the efficient. We need strenuosity to help fix quantity standards, because when the strenuous man is properly guided and handled, he gets a maximum quantity efficiency. But he must be guided.

The systematic type furnishes these reliable records by which we keep track of the efficiency, find it out and establish its standards. But left to himself without guidance, the systematic type of man runs to seed. He becomes petrified in the attitude of changeless superiority. It is only the efficient man that can be left alone, because he will not leave anything alone.

The systematic man, of course, is the stand-pat and conservative mind at work. He prefers to write history rather than prophecy. His mind is set towards the setting instead of the rising sun. He compares today's result with yesterday's result, instead of comparing it with the ideal standard of tomorrow.

The systematic manager inevitably curtails initiative in the plant, for he sets wage limits instead of work limits. He is not concerned about the value so much as he is concerned with the price.

The efficient man is after what we shall do to be perfect. The systematic man is content if he has properly taken care of today in comparison to yesterday. The efficient man is principally concerned in seeing that tomorrow is taken care of in order that to-day will automatically be looked after.

Place the systematic man in charge of your cost work. He is perfectly content if he can devise a system that will attach a string to every dollar, with the consequence that in the hands of the small systematic man, a cost system rarely gives costs, though it produces a lot of figures.

The great fallacy in costs, as some of the efficiency experts have pointed out, is to generalize from the whole to a part, to apply data covering a ten year period to a lesser period, down to a day. Averages are the pitfalls of the system-mad cost accountant.

"The average temperature, or rainfall, ought not to be taken as the weather indication for an outing," is the witty way Mr. Emerson has put this failing. In his book he brings out one very important item by a very vivid comparison. There is a difference between expense and cost. If a salesman on the road paid 25 cents for a cigar with a hundred dollar bill and neglected to get the change, the trip cost you $100, but the expense was only 25 cents for the cigar.

The systematic cost man wants only to know what becomes of the money the material and the work where it has gone.

The efficient man wants to know what you have gotten for the money, and vitally important, if what you received in return for the money is worth the price. We have crude so-called cost systems which do not reflect the activities of a business at all. Merely because a man is systematic, merely because he has a system, is no indication that the system is telling him any usable facts about his business.

It is important therefore, in the establishment of a cost system to pre-determine what you want it to do.

You can't let a cost system just grow.

If you do let it grow, it will grow in many ways that will be expensive and bristling with misinformation pitfalls for your unwary judgment. Put in a cost system by all means. Bring to bear upon the problem the same concrete information, skill, experience and attention to scientific detail you would in making an installation of an electric power plant, or a transmission system, or putting up a new factory building.

As a matter of fact, what do you know about the matter of costs? What do you want a cost system to tell you? If you want to have a cost system to help produce a greater efficiency, then you want it to aid in a real managerial function. If you want it merely as a supplementary historical record to be tied into your accounts, then a mere cost system will do.

But make no mistake, that kind of a cost system will give precious little aid in raising the efficiency of management.

The cost system that doesn't tie up with production standards; that doesn't show how closely you have come to realizing the best way of doing anything; in other words, that doesn't give values as well as costs, is a misnomer, and one that is destined to breed narrow, cribbed and inefficient management. Therefore, and cost system should be, as Mr. Emerson points out, so arranged that it gives:

To the comptroller—information that will show him where the money goes.

To the efficiency engineer—information to show him whether standards are being realized.

To the manager—information to show him where his losses are occurring and his highest efficiencies are being realized.

In order to do this Mr. Emerson continues:

The requisition system must be increased. You apply requisitions to materials—why shouldn't you apply them to personal services and other charges?

This brings us to the newest type of management, which has always existed wholly or in part, but has only recently been given a new name, because it has only recently been recognized as a type.

The largest flag pole in the world has been raised on the grounds of the Panama-Pacific International Exposition on the site of the Oregon state building. The pole was shaped from a single fir tree given by the citizens of Astoria, Oregon. It is 230 ft. long and 6 ft. across the butt end. A flag 46 ft. long was raised on it on June 6, 1914.

LIGHTING METHODS

QUARTZ LAMP CHARACTERISTICS AND COMMERCIAL USES.

(This article describes the use of the Quartz lamp and its operating characteristics. The fields, other than for lighting, in which it has found application are also mentioned as indicating new uses for central station service.—The Editors.)

With the advent of the gas-filled incandescent lamp and the recent improvements in the flame carbon lamp it is interesting to note some of the characteristics of the quartz lamp which is also coming to occupy an important place in the field of artificial illuminants.

The construction details were described and illustrated in the Journal of Electricity, Power & Gas, February 1, 1913, and installation data in the issue of March 14, 1914. It is therefore believed that the readers of the Journal will be interested in some of its operating characteristics and commercial uses.

In the well known Cooper-Hewitt glass tube mercury vapor lamp, the light is produced by a luminescence of the vapor and is strictly a line spectrum, while in the quartz burner, a band spectrum is obtained by the heating of the vapor to incandescence.

The result of this is that a certain amount of red is introduced, but not enough to eliminate entirely the characteristic green color of the mercury vapor lamp.

The color of this light, according to measurements made by Dr. Herbert P. Ives, with his colorimeter, is exceedingly close in integral color to average daylight.

On account of its extremely high efficiency the quartz lamp has found wide application in the lighting field though the color of the light has limited the application more or less to industrial work.

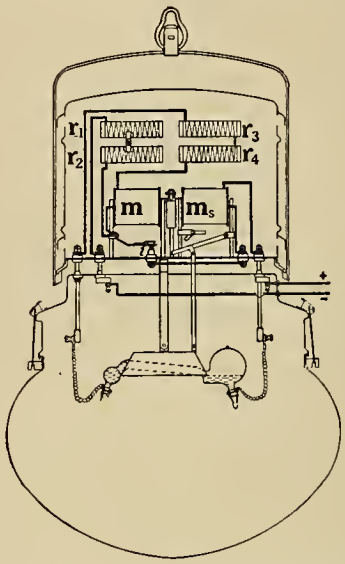
Due to the large flux obtained, it is possible to mount the 220 volt lamp in shops up over cranes at a height approaching 100 ft. and yet obtain excellent illumination on the floor. Owing to the absence of any necessary trimming, the lamps can be mounted in inaccessible places without building special platforms or runways for the attendant. The burners when properly adjusted permit of a reasonably wide variation in line voltage enabling the lamps to be operated on ordinary power circuits with no difficulty whatsoever. Among the more successful fields of application of the quartz lamp so far developed might be mentioned; engine rooms, smelting works, armories, automobile, shipbuilding, locomotive and plate glass plants. In fact the lamp is adapted for any industrial application where the necessary height for good distribution can be secured.

Yard lighting is another field in which the quartz lamp has proved satisfactory, the best results being obtained by placing the lamps on poles at a height ranging from 40 to 70 ft. above ground.

A number of small installations of street lighting have been made in co-operation with business men's associations, but the number has been restricted owing to the lamp not being adaptable for alternating current or on series circuits. However, with the advent of a lamp so adapted, there is no doubt that it will become popular for this purpose. Lamps hung 40 ft. above the sidewalk give fairly even illumination over streets from 60 to 80 ft. wide.

The color of the light afforded is often appreciated by the merchant for the contrast afforded between it and the window illumination which brings out the latter more prominently.

An interesting example of lighting by the quartz lamp is that of lighthouses for the U. S. Government. The Light House Board has proved that this



Section Through Commercial Type of Quartz Lamp.

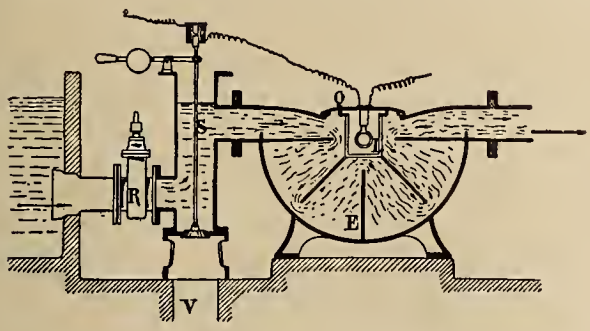
lamp is excellent for ordinary light house lenses. Its color also affords light entirely distinctive and prevents the confusion of the lighthouse light with a fixed white light ashore. Quartz lamps are now being used to illuminate the memorial tower of the Seamen's Institute near Brooklyn Bridge, New York City, and the light, which is the only green one on the coast, has been designated and charted as an official light by the light house department.

Naturally, with the high efficiency lamp the question of maintenance is an exceedingly important one. In the case of the quartz lamp the replacement of the burner is practically the one item entering into this account, and when a burner is broken or loses its vacuum it is not necessary to purchase a new one as this one can be refilled, and there is always some scrap value for the old burner. As far as can be ascertained from the figures available at the present time, the cost per 1000 hours burning will average somewhere between $4 to $5.50 for the 220 volt lamp.

A study of the spectrum reveals a presence of ultra-violet rays, though in the commercial lamp these are absorbed by the enclosing glass globe. These rays are chemically active and are capable of utilization in commercial applications, such as photography, industrial chemistry, pathology and sterilization, some of which are described herewith.

Extensive experiments made on the bacterial effect of the Quartz tube light on microbes reveal the following facts. That for short distances, the 220 volt lamp is five times as active as the 110 volt lamp and for greater distances (24 in.) it is ten times as great; the action is independent of temperature, and the absence of oxygen does not decrease the speed with which it takes place.

The action may be retarded from a period of a few seconds to one of from 3 to 5 hr. by interposing



Section Through Quartz Lamp Sterilizer.

a sheet of clear glass a fraction of an inch thick. Sheets of mica also have a retarding effect.

These facts lead to the conclusion that there is a wide field opened for the lamp in the sterilization of milk and water and such is the case, a number of plants for this purpose having been established in small towns in France and Italy where the water supply is being completely sterilized by the use of the quartz lamp. No plants on a large scale for this purpose have been erected in this country, as yet.

The apparatus used for this purpose possesses some features which are unique and which will doubtless prove of interest to Journal readers.

It consists, as shown in the accompanying illustrations, of a cast iron container, having mounted therein a quartz lamp in a box with windows of quartz on three sides. The water flows in towards the light and by means of baffle plates is made to come in contact with the ultra violet rays three times. To prevent any water from flowing through the sterilizer when the lamp is not operating, a magnet is placed in series with the lamp which opens a drain valve when the lamp ceases to operate and allows the water to pass out through another opening. A filtration plant is generally operated in connection with the sterilizer as the water must be free from dirt. The outfit described herewith is capable of perfectly sterilizing 130,000 gal. of water per 24 hr. day at an energy consumption of 725 watts.

While the sterilization of water may be efficiently carried out as explained, the commercial sterilization of milk is not such an easy matter, owing to the fact that milk in bulk is impervious to the ultra violet rays. This obstacle which has therefore prevented the commercial adoption of this idea, can be overcome by running the milk in thin streams over drums or plates and allowing the rays of light to impinge thereon.

Equally interesting are a number of other uses of the light from the quartz lamp which are now being developed commercially. Perhaps the one that appeals to the greatest number of people is that of photography. For this class of work it can be substituted for the different types of arc lamps at present in use consuming from 20 to 30 amp. with their attendant higher costs of maintenance and operation.

An outfit has been especially designed for use in connection with either the ordinary skylight or a mercury tube light for high class portraiture and window picture work. It is also used in obtaining Rembrandt effects. The burner in this outfit is equipped with a parabolic reflector enclosed in a metal box with diffusing glass and the lamp can be adjusted for any height and any direction, so as to give spot light effects.

The lamps are also used in moving picture studios, and blue printing machines, a special lamp being developed for the latter.

Flour may also be bleached by the rays from the quartz lamp, in which case, however, the ionized air generated by the lamp must be prevented from coming into contact with the flour because of the deleterious effect it would have on its food value. This is accomplished by enclosing the lamp in a quartz box.

Still another industrial process is the "debloom-ing" of hydro-carbonate and vegetable oils and paraffine. The old method was to expose the oil in shallow uncovered tanks to the sun rays for a number of weeks. By exposure to the rays of the quartz lamps, the same results may be obtained in much less time.

The fixation of patent leather according to the established method is accomplished by varnishing and baking the leather and then exposing it to the sun for a period of at least ten hours. By substituting the quartz lamp for the sunlight this period may be reduced to three hours and the operation then performed under atmospheric conditions most conducive for effective work.

Finally, among the applications to be mentioned, and of very general interest to the public at large, is the use of the ultra-violet rays to replace sunlight in testing the permanency of colors in different fabrics. Formerly, this required the exposure of the sample to sunlight for periods aggregating 72 hr. on clear days, whereas with the quartz lamp the same results can be obtained in a very few hours.

From the results already obtained in the application of the quartz lamp to various industries, some of which have been mentioned, it is safe to predict that the lamp, in addition to its own particular field of lighting, is destined to play an important part in the field of industrial development.

Prospecting for oil in Alberta has resulted in the discovery of a fine quality of oil at a depth of 2700 feet, in what is called the Dingman well, near the city of Calgary. The oil is of such a high grade that it can be used successfully in automobiles after having passed through the filter. Gravity tests of the oil are said to show 64 degrees Baume. It is stated that 900 gallons were taken from the well in 6 hours. Six other companies are prospecting, and numerous companies have been organized since the discovery of the flow in the Dingman well. Drilling outfits are being ordered by wire and operations will be carried on extensively.

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Brains as an Ingredient.
Keep Informed.
Free Phones and Fares.

Brains as an Ingredient

Those innovations which represent the most radical departure from accepted practice usually meet the greatest opposition. The reason may be that it is difficult to spill from the mind that which is already known to be of comparatively successful application. Yet this spilling process is essential, in order that the advantages resulting from progressive practices may be fully enjoyed.

It seems anomalous to speak of brains as an ingredient, but when used, it generally follows that the more gross materials are reduced in quantity, thus resulting in a desirable economy. The use of this most expensive ingredient insures the lowest effective cost.

The article appearing in this issue on the Multiple-Arch-Dam is therefore of especial economic interest. It discusses a subject of vital importance to the wide hydroelectric power, water supply, and irrigation interests of this last West, emphasizing as it does, an economy of construction due to the application of engineering skill.

Reduction of cost in dam construction has often been deplored as contributing to a lower factor of safety, but the construction discussed permits a dam of extremely low cost, yet having a greater than usual factor of safety combined with permanence.

Cheaper structures are not necessarily caused through the financial limitation of the builders, nor upon a sacrifice of safety.

Multiple arched dams also make possible an economy of time in construction, as only one-third or less than the material usually required has to be placed.

Economy is seen to consist in the elimination of excess without impairment and preferably with improvement.

The principle of construction discussed is not new measured from the time of its first use, though in more crude form, but is certainly so with regard to its more advanced design and possibilities of more general adoption. This may be temporarily retarded due to that type of commission control which places a premium upon the amount expended rather than upon the skill displayed in construction of the works upon which it is expended.

The Meer Allum Dam, embodying the fundamental principles of this design, was erected in India, as far back as 1800. It is about one-half mile in length, and consists of 21 arches, with spans varying from 70 to 147 ft.

Yet notwithstanding its early adoption, there has existed until quite recently a dearth both of publicity and information regarding this desirable type of construction. Even in some of the latest works on the subject, the ideal conditions in connection with the choice of a dam site do not appear to consider the possibilities and the advantages of this type, though it is almost invariably referred to, in a brief paragraph, as being a very desirable method of construction. Some even go as far as to exclude design as a fundamental constructional consideration, though mentioning quantity of material in this connection.

Dams depending upon mass for their stability do not, however, differ widely from those built by the

pioneer Beavers from whom man perhaps first conceived this idea of hindering the stream flow and of holding it to controlled and more complete uses of increased value.

But the economy and safety effected by design, and its ability to successfully withstand the incident stresses are of more importance than the availability or character of the material entering into its construction. The weight of skill tips the beam in its favor and brain as an ingredient is found to be heavier than matter.

This is interestingly indicated in the captions illustrating the article referred to, where it is shown that a multiple arched dam depending for its stability upon scientific design, although having a safety factor two times as great and giving three times the storage capacity, was built at the same cost as the old dam first constructed, which depended upon weight of material for its stability.

With the multiple arched dam there is also an admitted freedom from upkeep, and in that it is comparatively water tight there exists also an economy of conservation.

By the use of apparatus of scientific design, together with the application of a few simple rules, it is sometimes possible for the novice to readily solve problems previously difficult of solution. In this connection it appears unnecessary to point out that the article in this issue does not profess to teach the tyro how to successfully build a multiple arched dam. Dam sites vary so widely that it rarely occurs that one design is suitable for two of them, and the services of a competent and qualified engineer will always be necessary for the successful completion of any such project.

Some of the questions which the author propounds are answered in a practical manner by the successful erection and performance of dams of this type erected in the West, such as that illustrated, the Hume Lake Dam, described in this Journal for October 30, 1909, the Los Verjels Dam, and others, while the technical question propounded by the author is ably treated in the article.

Keep Informed

On account of the greater areas, rural as well as urban, now covered by central stations, together with invention and a cheapening of product, there has been opened up a field so vast that the special training of salesmen is now essential if satisfaction is to result.

In selling electric service the salesman must realize that the service is not complete until he has done his part.

There is a definite connection between satisfied customers and sales which stay put. The connecting links are trained salesmen having active interest in their customers' affairs.

A trained salesman of electric service is one having a complete understanding of the science of salesmanship, together with knowledge of his commodity, of his customers' requirements and the manner in which these may be filled.

The value of each salesman is in direct proportion to his ability to serve. This in turn depends to a large extent upon his fund of specialized knowledge.

The reason why some men do not accomplish more or gain advancement, is that they do not know enough and are satisfied instead with their ability to temporarily hoodwink their employers as they short-weight the "service" doled out to customers.

Keep informed.

Free Phones and Fares

There exists in many municipalities a condition which would not be tolerated by any public service commission having that broad outlook essential in such bodies, in order that the interests of all the people be adequately protected.

This condition results from political control of public utilities by the municipalities, and is consequently unfair.

The desire for something for nothing, or a mistaken sense of economy, has caused many municipalities to insist upon free telephone service for civic buildings, and of street car passes for city employes.

In the days when sops of this nature were necessary for the betrayal of the public, success along these lines might have been considered good practice, but there is now a growing appreciation of the necessity for the conduct of all business upon strictly business lines.

There is also the realization that the use of public utilities which name conveys the impression of general use by all the public, is really restricted and variable.

The necessary use of the telephone for the transaction of civic business requires the incurrence of legitimate expenditure, as also does the use of street cars by city employes while engaged in their official duties.

Street car fares and telephone tolls are a tax upon their respective passengers and subscribers. It cannot be disputed that both free fares and phones find their way into the taxes paid by those using these utilities, while the non-user—and their name is legion notwithstanding the premier position of Pacific Coast cities in the development of telephone service and the creation of traffic records—have their direct taxes reduced by this amount.

Such a condition is certainly unsatisfactory and unjust, for apart from the generally wasteful use of that which "costs nothing," it is admittedly unfair to saddle utility users with the additional expense of conducting these necessary branches of public service, which for the proper distribution of this tax burden should be paid by all.

It is stated that in San Francisco, the item of free civic telephone service alone necessitates the investment of one million dollars

The existence of such an undesirable condition of affairs at this stage of commission control is but a further indication of the need for all utilities if they must be controlled, to come under the control of but one public service commission.

Probably the jurisdiction of the federal commissions may be extended, and ultimately become the logical court of appeal. This is a question calling for early consideration by those in favor either of state or federal control. But in the interim the need is seen to exist now for that wider and more uniform interpretation of the law, and that rendering of justice which would naturally result from the unvarying control of all public utilities by the state.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

L. G. Harkness Smith of the educational department, So- presentation of some interesting features here at that time.

A. Terkel, president of the Reedley Telephone Company, Reedley, Cal., was a visitor at San Francisco during the week.

George Cook of the American Cross Arm Company was in Seattle last week.

L. A. S. Wood, arc lamp specialist with the Westinghouse Electric & Manufacturing Company. is at San Francisco.

Chas. W. Baker, district engineer with Westinghouse Machine Company, Hunt, Mirk & Company, Pacific Coast agents, is at Visalia, Cal.

E. M. Cutting, of the Edison Storage Battery Supply Company, San Francisco, is making a business trip through the Pacific Northwest.

Frank Fowden of the Brooks Follis Electrical Corporation, San Francisco, is making a business trip through the Sacramento valley.

E. B. Walthall, assistant general manager, San Joaquin Light & Power Company, was at San Francisco from Fresno during the past week.

W. L. Overman, representing the Hughes Electric Heating Company, has located in Seattle. Mr. Overman recently spent a week in Portland.

K. G. Dunn, vice-president, Hunt, Mirk & Company, San Francisco, is on a business trip to Alaska and will also visit cities in the Pacific Northwest.

H. C. Goldrick, Pacific Coast manager Kellogg Switchboard & Supply Company, has returned to San Francisco from a short trip to Oregon and Washington.

H. D. Brainard, sales manager of the Western Electric Company at Seattle, recently returned to Seattle from Portland, where he spent a week with the Portland branch.

Hal Lauritzen of the Holophane Works of General Electric Company, is at Los Angeles on special business and will return to San Francisco during the early part of next week.

V. R. Lansingh, manager glass and steel reflector department National Quality Division of General Electric Company, has returned to Nela Park from a six weeks' trip to Europe.

J. B. Rowray, superintendent Northern Electric Railroad, will continue to conduct the business of his department from Chico, Cal., as it has now been decided not to remove his office to Sacramento as previously intended.

N. C. Kingsbury of New York city, vice-president of the American Telephone & Telegraph Company, the parent company of the Bell interests. arrived at San Francisco last week and is now at Los Angeles.

John B. Fisken, superintendent light and power department Washington Water Power Company who is chairman of the Spokane Section A. I. E. E., will attend the annual convention of the Institute at Detroit, Mich.

E. S. Berdine, Pacific Coast representative of the Gleason Tiebout Glass Manufacturing Company, has just returned to San Francisco from Los Angeles and reports having secured a stock order from the Mayberg Company, whose premises were recently partly destroyed by fire.

Leonard Lundgren, Assoc. M. Am. Soc. C. E., District Engineer United States Forest Service, has been transferred from Denver, Colorado. to Portland, Oregon. The territory embraced in the Portland district includes the National Forests in Oregon, Washington and Alaska.

Bertram Smith, assistant manager of the Pacific Coast Division of the Edison Storage Battery Company, returned to Salt Lake City from Butte, where he had gone in connection with some orders for electric truck sprinklers and fire equipment now under consideration by the Butte city council.

E. H. Richardson, secretary of the Hotpoint Heating Company, at Ontario, Cal., has announced that his company has made arrangements to give employment to the entire graduating class of the California George Junior Republic, in Southern California. There are twelve in the class, which will graduate this month.

F. V. Cook, representative of the Ohio Brass Company in the Intermountain territory, with headquarters at Salt Lake City, has recovered from his injuries sustained in an automobile accident in Ogden Canyon. **O. W. Hershey,** special representative of the Westinghouse Lamp Company, is still confined by his injuries at the hospital in Ogden.

Bion J. Arnold, Chicago traffic expert, with his staff of assistants, commenced last week an inspection and appraisal of the property of the Oakland, Antioch & Eastern Railroad as the representative of eastern and western stock holders. Mr. Arnold is stated to have said that, so far as his investigation has gone, he has found the railroad a valuable property.

W. A. McGovern has been appointed general manager of the Northern Electric Railway Company and took charge of his new office on June 15th. Mr. McGovern has been assistant division superintendent at Pocatello, Idaho., on the Oregon Short Line. For many years previous he was connected with the Southern Pacific as division superintendent at Oakland.

J. M. Barry, who has been elected head of the department of electricity to the position formerly held by **William J. Nixon,** arrived in San Francisco from Portland and assumed the work of his new office. By the action of the board of supervisors in relaxing the residential qualification in his favor, it made his election possible, and at a joint session of the fire and police commissions he was duly elected to the position.

L. G. Harkness Smith of the educational department, Society for Electrical Development Inc., New York, who has been at San Francisco for the past week, left for the south on Friday, but expects to return about the middle of July. The Journal is giving due notice so that all electrical men whether members of the Society or not, will plan to enjoy Mr. Smith's presentation of some interesting feature here at that time.

R. W. Tavey, engineer from the National Lamp Works of the General Electric Company is in Salt Lake City. Mr. Tavey is making a tour of the western states visiting all of the Western Electric Company offices in that territory with special reference to the introduction of the "Type C" Mazda lamp. He reports that it is taxing the capacity of the factories to supply the demand for this unit which is meeting with especial favor for exterior lighting purposes.

M. F. Lewis, factory representative of the Olston Electric Stove Company of Los Angeles, gave a box party at the Empress theatre. Thursday, June 11th. Robert Hall, the clever impromptu song monologist, was on the bill and being a personal friend of Mr. Lewis, had considerable fun at the expense of the twenty odd electrical guests. Incidentally, the "Do it electrically" slogan received considerable publicity in Mr. Hall's impromptu jingles, and made quite a hit with the regular Empress patrons. After the show the party adjourned to Maxim's.

J. Harry Pieper, of the Southern California Edison company, who arranged the program, presided as chairman at the Los Angeles Ad. Club luncheon last week. The principal speaker was **B. F. Pearson,** general superintendent of the Southern California Edison Company, who outlined the different features of developing electric energy and told how it is carried to Los Angeles, over high power transmission wires. **J. A. Quinn,** proprietor of the Garrick and Superba theatres, then told the ad men some of the advantages and benefits of electrical advertising. **Andrew M. Strong** of the Greenwood Advertising Company, described the construction of an electric display sign.

MEETING NOTICES.

Illuminating Engineering Society.

The report of the committee of tellers of the Illuminating Engineering Society on the results of the recent annual election, presented to the Council of the society June 11, showed that the following national officers had been elected for the ensuing year: President, Dr. A. S. McAllister; Vice-Presidents for two years, F. A. Vaughn and C. A. B. Halvorson Jr.; General Secretary, Joseph D. Israel; Treasurer, L. B. Marks; Directors for three years, Ellice M. Alger, Harold Calvert, V. R. Lansingh.

San Francisco Electrical Development and Jovian League.

The league met as usual at the Hof Brau Cafe and after luncheon listened with great interest to a talk given by L. G. Harkness Smith of New York, who has charge of the motion picture department of the Society for Electrical Development, Inc., on the work now being done by that organization. Short speeches were delivered by C. C. Hillis, R. M. Alvord, W. L. Goodwin and others. The chairman of the day was C. W. Wiggin. The meetings were adjourned for the summer months, the next meeting being called for the first Tuesday in September.

Jovian Electrical League of Southern California.

In spite of the warm weather, the attendance at the luncheons keeps up remarkably well, 125 members being present on June 10th, to enjoy the varied and interesting program provided by R. J. McHugh, chairman of the day. The musical treat consisted of songs by the charming entertainers, the Misses Dempster and Hogan. A subscription was taken up for the expense fund for the annual picnic to be held on June 20th and over $200 was subscribed in a few minutes. Two Jovian rings, presented to the league by the recent prize winners, Messrs. Drake and MacDonald, were raffled off and won by Messrs. McCutcheon and Colkitt, and the sum realized was added to the above fund. A few interesting remarks were made by Jovian Hardman of San Diego and Judge White, who appeared to have a "fine" acquaintanceship among the Jovians. A very interesting talk was then delivered by Louis G. Guernsey, political editor of the Los Angeles Times, his text being "Personal Aspects of National Characters." It was decided by the League to have no luncheons between July 1st and September 15th.

Utah Society of Engineers.

Dr. F. G. Cottrell of the United States Bureau of Mines delivered a talk before the Utah Society of Engineers at the Consolidated Music Hall on Wednesday evening, June 10th on his electrical system of smoke deposition. His talk was an especially timely one in view of the strong agitation which has developed in Salt Lake City during the past three or four years looking to some solution of the smoke nuisance, which has become so serious with the rapid growth of the industrial plants in this city.

Dr. Cottrell pointed out that it was known as early as 1824 that finely divided solid particles carried in suspension in the air could be deposited on a plate by means of a brush discharge from a static machine in the field. No practical progress was made however, owing to the fact that the static machines available at that time were entirely inadequate in commercial application. Again in 1850 in an article in the Mechanics' Magazine of London the same phenomena was reported and attention was called to the fact that this could be used for the purpose of throwing down finely divided particles carried in suspension in the air. Sir Oliver Lodge in 1884, without a knowledge of the work of previous discoverers, reported before a meeting of the British Society of the Chemical industry his discovery of this fact, and patents on the general principle were taken out at that time in Great Britain and several other countries. These patents have long since expired.

In 1905-6, Prof. Cottrell, then connected with the University of California, took up the work. The big advance which he made in the process consisted in the abandonment of the static machine as a source of high potential direct current. He arranged to tap off the peak of the voltage wave from a high potential alternating current circuit, thus securing a high potential uni-directional source of energy. This permitted the practical application of the process to sulphuric acid plants, powder works, cement plants, and smelters.

At Riverside, Cal., ninety tons of cement dust per day are recovered from the flues of the Riverside-Portland Cement Works plant by this process with an expenditure of only thirty-five kilowatts of energy. It is reported that the waste product recovered practically pays for the expenses of operating the system.

Dr. Cottrell frankly states, however, that he does not see how this process can be successfully applied to the solution of the smoke problem in Salt Lake City except in special cases. He believes, however, that the solution lies more in the direction of securing a smokeless fuel and urged that the city take steps to have a careful economical survey made to determine whether or not the problem may be solved in this way.

CALIFORNIA ASSOCIATION OF ELECTRICAL CONTRACTORS.

The fifth annual convention of the Association will be held at Sacramento, Cal., on August 5, 6, 7 and 8, 1914, the Hotel Sacramento having been selected as the convention headquarters. The secretary has made the following announcement to the electrical fraternity of California: "Co-operation means to get together for the promotion of a common interest. You are invited to co-operate with the electrical contractors at this convention.

"In addition to the regular business of the convention, there will be two open meetings, at which papers of interest to the entire fraternity will be presented. The committee has also arranged a splendid entertainment program, so that ladies and guests will not have a dull moment.

"Take your family with you and make this your annual vacation."

The preliminary program is as follows:

Tuesday, 9:00 a. m.—Executive Committee meeting.
Tuesday, 2:00 p. m.—Executive Committee meeting.
Wednesday, 9:00 a.m. to 12 m.—Meeting for members.
Wednesday, 2:00 p. m. to 6:00 p. m.—Meeting for members.
Wednesday, 1:30 p. m.—Ladies and visitors boat trip down Sacramento River. Refreshments on board.
Wednesday, 8:00 p. m.—Reception and dance, banquet room, Hotel Sacramento.
Thursday, 9:00 a. m. to 12:30 p. m.—Meeting, members only.
Thursday, 2:00 p. m.—Every one take auto trip to Folsom.
Thursday, 8:00 p. m. to 12:30 a. m.—Moonlight boat ride. Dancing on boat.
Friday, 10:00 a. m.—Open meeting.
Friday, 1:30 p. m.—Sightseeing auto trip.
Friday, 2:00 p. m.—Open meeting.
Friday evening—Annual dinner and ball.
Saturday—Annual outing trip on river. Dancing on barge. Games and lunch on shore.
Saturday, 8:00 p. m.—Jovian Rejuvenation

PUBLICATIONS RECEIVED.

Power Plants for Textile Mills are fully described in Number 7 of the Textile Quarterly issued by the Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa.

A booklet containing complete information regarding membership and organization of the Electric Power Club, which has for one of its objects the standardization of electrical machinery, is to hand. It is also a report of the work thus far accomplished by the club and by its predecessor, the American Association of Electric Motor Manufacturers. The booklet is offered in the hope that further standardization will be encouraged and in full belief that the practices suggested are fundamentally correct and will be valuable in guiding the development of electrical apparatus.

ELECTRICAL CONTRACTORS' DEPARTMENT



A Real Convention Crowd, Oregon Electrical Contractors' Association.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION.

The second annual convention of the Oregon Electrical Contractors' Association was called to order at 9:30 a. m., on June 8th, by J. E. Werlein of the Portland Railway, Light & Power Company. Mayor Albee of Portland was introduced and made a few remarks in behalf of the city of Portland. In brief he stated that the city was taking note of the work of the organization and that he wished to extend the hand of fellowship and to impress upon their minds the fact that the city's welcome was hearty and sincere. Mayor Albee was made an honorary member of the association.

R. G. Littler, president of the Oregon Electrical Contractors' Association, responded to Mayor Albee's remarks. Mr. Littler stated that the Oregon Electrical Contractors' Association now had forty members and that the association had lost two members during the past year through the death of Geo. Ormsby and Charles Potter. "This convention is being held for both business and pleasure," said Mr. Littler, "and the organization hopes soon to have all the best contractors in Oregon as members of the association. Great importance must be given to the campaign this fall for a state license law. Tendency of a good and sufficient state license law to eliminate the curbstone contractors which has been borne out by the experience of Memphis, Tennessee. An effort was made last legislature to have a state license law enacted in Oregon, but due to the confusion of understanding regarding its purpose and issues at stake the bill was defeated."

The slogan of the convention was "Do It Electrically," and this fact was impressed upon the members by Mr. Werlein, after which he handed the gavel to President R. G. Littler, expressing the wish that the third annual convention would be even more enjoyable. Geo. L. Baker, manager of the Rose Carnival Committee, stated that electricity played a big part in making the carnival a success. A letter was read by the president from G. W. Hill, special representative of the N. E. C. A. This letter was full of witty stories and emphasized the fact that there was always strength in organization. Ernest Freeman, president of the N. E. C. A., had been invited to attend the convention, but was unable and sent a letter expressing regrets.

Ross Hartley presented a paper entitled "The Electrical Jobbrs." Mr. Hartley is manager of the Pacific States Electric Company at Portland, Ore. Mr. Hartley's paper was quite original and emphasized the general movement all over this country for the inauguration of better business. The next paper read was from J. M. Wakeman, manager of the Society for Electrical Development, the title of his paper being the society of which he is manager, the paper being read by J. R. Tomlinson, who was followed by Mr. Underwood, treasurer of Failing, McCalman Co., who read a paper on "Fire Causes and Prevention."

At the 1:30 p. m. business meeting many matters of interest to members were brought up and discussed. The proposed state license law, which will be introduced at the next meeting of the Oregon Legislature, called forth a great amount of discussion. The association has a committee working upon a re-draft, which will soon be perfected. On the completion the proposed law will then be submitted to the different organizations throughout the state for their approval and support. The proposition of amalgamating the State Association and the Portland Electrical Contractors' Association, was also brought up and referred to a committee to report on same. The association elected J. R. Tomlinson to be the next director, representing the state of Oregon in the national convention. Also to go to Detroit to attend the national convention in July. It was voted to request the N. E. L. A. to send their special representative, Geo. W. Hill, to this coast as his assistance is needed in increasing membership and reviving the association spirit on the coast.

The entertainment part of the program was carried out as previously reported.

In the evening the delegates and guests, numbering 200, assembled in the main dining room of the Portland Hotel for the annual banquet. J. E. Werlein, presided as toastmaster and the speaker of the evening was Franklin T. Griffith, president of the P. R., L. & P. Co. In addition to the talk of the evening several entertainment features were provided.

NEW CATALOGUES.

Sprague Electric Hoists are described pictorially and with a very clear text in Bulletin 905 just issued by the Sprague Electric Works of General Electric Company.

"Westinghouse Railway Data Exchange" No. 8, just issued by the Westinghouse Electric & Manufacturing Company, deals with the efficient use of cars, giving considerable data as to the relative cost of operation of different systems.

"Westinghouse Wicker Type Electric Linotype Pots" is the title of a somewhat elaborate publication (No. 1531) just issued by the Westinghouse Electric & Manufacturing Company, on this subject. The linotype pot is thoroughly described and illustrated and its advantages are explained in detail.

The Electric Storage Battery Company has recently published a new bulletin on "The Ironclad-Exide Battery for Storage Battery Locomotives." In addition to giving a clear description of the apparatus, it contains valuable information to engineers who are interested in the subject of storage battery locomotives.

"Drawing the Crowd and Keeping It" is the title of a folder (No. 4277) just issued by the Westinghouse Electric & Manufacturing Company, with an attractive cover showing a large crowd being attracted to a 5 cent moving picture theatre. The folder deals with arc lamps for illumination and projection purposes, rectifiers, ozonizers and radiators, all of which are used in these theatres.

CALIFORNIA ASSOCIATION OF ELECTRICAL INSPECTORS

Section of N. A. E. I.

C. W. Mitchell, President. Arthur Kempston.
Wm. G. Pennycook, Vice-Pres. B. C. Hill, Executive Comm.
John W. Carrell Secretary-Treasurer, 55 Fulton, San Francisco.

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correllate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

SPECIAL INSTALLATION RULES.

The National Code is the correlated result of many mature minds working from diverse viewpoints but to a common end, guided by a large body of men who are responsible for the financial result of its application in the field. A document which sets forth purposes to be accomplished in a large and varied field of construction for a nation—almost for a continent—is remarkable. The Code does more than this: It points out methods by which its purposes should be accomplished in detail for the more simple or well-established methods, but mostly in mere outline, leaving the minor details to the good judgment of the mechanic, the inspector or the engineer. If in the handling of the details the personal equation did not enter and if all concerned clearly understood the purpose of the Code, if the rules could be always interpreted alike, and minimum requirements were not usually considered maximum requirements, perhaps no confusion could occur; but experience has proven that confusion does occur and that it exists where fire and life hazards are dealt with and where many men secure their livelihood may be regarded at least as something more than a tempest in a teapot. Special rules are needed, but not many rules; a few well studied and well arranged.

There are some very reasonable objections to special rules. Could some modern disinterested Diogonese be induced to turn his flashlight on the inspection service in two cities, one where complete order maintained and one where confusion prevailed, a principal reason for the results in both cases would be, "Special Rules."

To weave a tangled web of words to cover a special idea or case and to put these forth as a general mandate for all cases has been the well-intentioned result of some inspection bureaus. Again the sources of interpretation in adjoining districts vary and the interpretations or special rules, however clearly set forth, differ widely. Special rules should be arranged with great precision and clearness, with proper correlation with existing rules and after conference with able men having special knowledge of the subjects treated, or not at all.

The C. A. E. I. holds a meeting at San Jose this afternoon, June 20th, in the Chamber of Commerce. An effort will be made to start a schedule of common practice based entirely on the Code and calling into play all the special knowledge possible on the subjects treated. All members of the association, as well as all other men engaged in electrical inspection service, should make an effort to attend this meeting.

OREGON RAILROAD COMMISSION

General regulations governing overhead and underground power lines within Oregon, have been issued by the commission. These regulations were originally issued August 29, 1913 and became effective October 1, 1913. The present construction of telegraph, telephone, signal, trolley and regulations are as amended April 23, 1914, and made effective May 12, 1914.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The Railroad Commission has rendered a decision in which it authorizes the San Joaquin Light and Power Corporation to issue 5 per cent bonds in the sum of $3051.00 and the San Joaquin Light and Power Company to issue 5 per cent bonds in the sum of $129,000. The bonds to be issued are to be used for the purpose of retiring outstanding underlying bonds.

The commission has issued an order calling inquiry into the rates, charges, rules, regulations, practices and service of the Western States Gas & Electric Company in the sale of electricity in Sacramento, San Joaquin, Eldorado, Amador and Calaveras counties.

The commission has rendered a decision granting authority to the Southern Counties Gas Company, operating in Orange county, to cancel an escrow agreement covering the unissued portion of its preferred stock. The company had placed $150,000 of its stock in escrow and the commission's order will enable it to return this stock to its treasury.

The commission has rendered a decision granting authority to the Western States Gas & Electric Company to issue two promissory notes, one for the sum of $108,900 and the other for $232,100.

The Southern California Edison Company applied to the commission for authority to use $30,000 of bonds for the purpose of purchasing the Downey Light, Power & Water Company.

The Southwestern Home Telephone Company has filed a supplemental application with the commission asking authority to reissue three notes of a total sum of $8500.

The commission has rendered a decision granting authority to the Fresno Interurban Railway Company to issue $120,000 in bonds and $60,000 in stock for the purpose of building a standard gauge electric railroad from Fresno to Clovis, a distance of 9 miles. The line will connect with the Fresno Traction Company.

The commission has rendered a decision authorizing the Northern Electric Railway Company to operate under lease the property of the Sacramento & Woodland Railroad Company. The lease is subject to revision or alteration by the commission, or other competent public authority, at any time, in any rate fixing inquiry or otherwise.

The Southern California Edison Company has filed an application with the commission for an order authorizing it to sell its electric distributing system at San Fernando, Los Angeles county, to the Pacific Light & Power Company.

The Southern California Edison Company has filed an application with the commission, in which it asks permission to purchase 1060 shares of the preferred stock of the Long Beach Consolidated Gas Company at 80. This is part of the 1400 shares, the sale of which had been previously authorized by the commission.

The commission has rendered a decision granting authority to the Southern California Edison Company to use a portion of the 5 per cent bonds heretofore authorized for the purpose of purchasing the Downey Light, Power & Water Company of Downey, Los Angeles county. The company asks for authority to use $30,000 of bonds for this purpose.

The commission has rendered a decision granting authority to Rose L. Burcham, the owner of a telephone company operating in Randsburg and Mojave in Kern county, and Atolia in San Bernardino county, to sell the plant to the Interstate Telegraph Company for the sum of $3,000.

The Fowler Gas Company, which is engaged in the manufacture of gas in the town of Fowler, Fresno county, has been authorized by the commission to issue 6 per cent 10 year bonds of the par value of $15,000. The proceeds derived from the sale of these bonds is to be used to retire certain outstanding notes and to make certain improvements and extensions to the gas company's plant.

TRADE NOTES.

Campbell & Rust, Electrical Contractors at Seattle, have recently secured the contract for the complete electrical equipment of the Lincoln High School at Seattle, Wash.

Tacoma headquarters of the Westinghouse Electric & Manufacturing Company have moved from 1211 Fidelity building, to 924 Commerce street. H. V. Wilkinson is manager.

The J. C. English Company of Portland, Oregon, has been awarded the electric fixture contract for Mrs. H. L. Pittock's residence on Imperial Heights, Portland, Oregon. Value of contract is $7700.

The electrical installation in the new fire-proof theatre to be erected on the southeast corner of Main and First streets, Portland, Oregon, has been awarded to the NePage-McKenny & Company.

Nearly 600 Mohrlite self-contained indirect lighting units will be installed in the new Call building, San Francisco. Forty-five of these units will be used for lighting the new Sunset Cafe, San Francisco.

Buxbaum & Cooley, electrical engineers, Seattle, Washington, recently sold to John J. Sesnon of Nome, Alaska, a sixty volt d.c. single-phase 5 h.p. generator set to be used in connection with freight lighters at that point.

B. F. Kierulff Jr. & Company, electrical jobbers, recently moved from 120 South Los Angeles street to 757 South Los Angeles street, where in the new and more commodious location, they are better prepared to handle the business.

Busch, Sulzer Bros.-Diesel Engine Company, New York, have just closed an order for 6-600 h.p. Diesel engines for installation in submarines L-5, L-6, L-7, being built by the Lake Torpedo Boat Company for the U. S. Navy. Four of these engines will be used for two of the submarines being built by the Craig Shipbuilding Company of Long Beach, the third will be built at Bridgeport, Conn.

A number of the employes of the Westinghouse Electric & Manufacturing Company and the Westinghouse Machine Company went on a strike last week, because the management refused to recognize the demands of the newly formed labor union, the Allegheny Congenial Industrial Union, and as a result the works of these companies at East Pittsburg are partly shut down. The management of the company does not believe that the trouble will be of long duration.

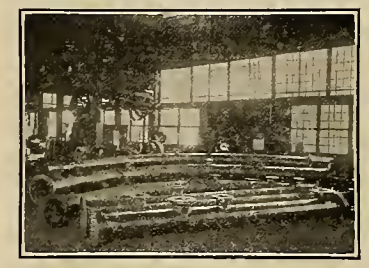
The fifth "Talking Sign" on the Pacific Coast has been erected in Portland, Oregon. The Motograph Talking Sign Company has its apparatus installed to operate the advertising portion of the sign. This feature requires the use of 1250 receptacles. The decorative feature will consist of about 1250 more receptacles forming a "rose bud" and two butterflies. A Reynolds Electric Flasher control is used. The complete sign was built for the Federal Sign System Company. The weight of the sign complete is approximately 8 tons. Its location is on the northeast corner of West Park and Washington streets.

Ground was broken for the new factory of the Holtzer-Cabot Electric Company on Amory street, Roxbury, Mass., at noon on Thursday, May 21. The ceremonies were of a private nature, and were attended by almost every employe of the company. It is expected that work will be pushed on the new factory and the company hopes to occupy its new quarters early in 1915. The building will consist of six stories with an ell of the same height, and will be of modern construction and equipment throughout. Funk and Wilcox are the architects, and Fred T. Ley Co., Inc., of Springfield and Boston are the general contractors.

Sixty distributors of the Premier Vacuum Cleaner Company from all parts of the country were guests of the big electric cleaner concern at Cleveland on June second, third and fourth. All were enthusiastic over the new plans announced which include the marketing of over 100,000 Frantz Premiers during the next twelve months. Edward L. Frantz, president, brought all present to their feet when he announced a reduction in the price from $30 to $25 and told about the $100,000 advertising campaign which starts immediately in the big magazines. The Premier Vacuum Cleaner Company started business four years ago in a single room with three employes. They now occupy a modern factory and employ three hundred men. Last year's output totaled over sixty thousand machines.

STEAM PIPE BENDS.

The H. J. Heinz Company are just completing an eight-story addition to their main factories at Pittsburgh, Pa. The first four stories are occupied by the boiler plant and the auxiliary machinery. The upper four stories contain 60 steam cooking kettles. The piping for this plant presents several novel and unique features, among which is the main steam header, consisting of 18 in. O. D. lap weld steel pipe ⅜ in. thick, totaling 162 ft. The flanges are rolled steel, attached by the Van Stone method. All inlets and outlets are forged steel nozzles welded to the 18 in. pipe. There are one 4 in., seven 6 in., one 8 in., six 10 in., one 12 in. and one 14 in. nozzles on this header. In the header are three 90 deg. bends, each bent to a 16 ft. radius and each containing approximately 40 ft. of pipe. This double length was obtained by welding together circumferentially two ordinary lengths of pipe.



Three Sections of Header and Three Bends

The connections from the triple duty valves on the boiler nozzles to the header are 10 in. in size and consist of special U-shaped bends made of a 2 ft. 7 in. radius. The accompanying cut shows three sections of the header and three bends with nozzles welded on.

The entire piping installation is being furnished by the Pittsburgh Piping and Equipment Company of Pittsburgh, Pa.

BOOK REVIEWS.

McGraw Electric Railway Manual; edited by Fred Nichols; 352 pages; 10x13. Published by McGraw Publishing Company and for sale at Technical Book Shop, Crossley Bldg., San Francisco. Price, $7.50.

The 21st annual number of the standard directory of American electric railways shows many changes which have taken place in the industry since the issue of the 1913 edition. As a manual for investors and salesmen desiring information as to the securities, earnings, officials and equipment of electric roads throughout the country it is without a peer.

Electric Light Accounts and Their Significance.—By H. M. Edwards. 172 pp.; size, 5x7½ in.; flexible leather binding. Published by McGraw-Hill Book Company, and for sale by Technical Book Shop, Rialto Bldg., San Francisco. Price $2.00.

The author, who is auditor, New York Edison Company, and member of the accounting committee National Electric Light Association, outlines in this work a system of accounts designed for electric lighting companies which he believes will prove entirely satisfactory as a means for providing those regulatory authorities having jurisdiction with all the information desired at any time, besides being of complete service to the company. The book's chief claim to the reader's interest lies, perhaps, in the explanations given of the terms used. It is in the "significance" to be attached to the matters treated that the author has endeavored to prove helpful.

NEWS NOTES

INCORPORATIONS.

SANTA ANA, CAL.—Beaver River Power & Plant Company, $100,000, by H. R. Waldo, G. F. Halliday et al.

PROVO, UTAH.—Certificate of the incorporation of the Southern Utah Power Company has been filed with the County Clerk. The company is organized under the laws of Delaware with Wilmington as the principal place of business. A. L. Woodhouse is president, H. R. Waldo, secretary and treasurer, W. L. Biersach is named as the agent of the company for Utah, and Provo named as the principal place of business in the state. The authorized capital stock of the company is 600,000 shares at the par value of $1.00 each. The company is organized for the purpose of taking over and operating the properties of L. L. Nunn in Sevier county which have been formerly operating under the name of the Beaver River Power Company.

ILLUMINATION.

AUBURN, WASH.—A franchise has been granted to J. L. Veach for the use of city streets for use of gas mains.

COVINA, CAL.—The Pacific Light & Power Company has given assurance of electric lights for Baldwin Park within 30 days.

HELENA, MONT.—The Caird Engineering Company has been given a contract for furnishing light posts for the sum of $6680.

TUCSON, ARIZ.—The city clerk has been instructed by the city council to advertise for bids for ornamental light posts on Congress street and Stone avenue.

TROPICO, CAL.—The board of trustees has awarded the contract for metal street lighting posts along Brand boulevard to the Newbery-Bendheim Electric Company, for $5188 complete.

ANAHEIM, CAL.—The proposition of installing an ornamental lighting system in the business district is to be taken up and pushed with vigor. Practically all interested property owners have signed up for the improvement.

SACRAMENTO, CAL.—Protests against the new method of fixing gas rates in Sacramento proposed in a draft of an ordinance by City Commissioner Charles A. Bliss have been made before the city commission by representatives of both the Sacramento Natural Gas Company and the Pacific Gas & Electric Company.

LOS ANGELES, CAL.—The residents of Huntington Park have started a lighted way from Los Angeles to Long Beach, a distance of about 20 miles. Arrangements are under way to induce the county supervisors to complete the system for the entire length of Long Beach boulevard. Huntington Park lights will start at Alameda and Clauson avenue and call for 98 cast iron posts, surmounted by 16 in. globes.

RIDGEFIELD, WASH.—Franchises for electric lights and a water system were recently granted to J. H. Cunningham, of Portland. Construction on the electric light plant and waterworks will commence as soon as possible and will be rushed to completion. Twelve months are allowed for the completion of the waterworks and eight months for the electric light plant. More time will be required for the completion of the electric light plant, and this work will be expedited as much as possible.

LOS ANGELES, CAL.—The knell of the electric liquor signs, and incidentally a dimming of the Great White Way as it exists in Los Angeles, was officially tolled last week. The electric liquor sign resolution was amended, and made far more drastic and the liquor interests given until July 1st to remove the offending signs. Not only do the signs advertising brands of liquors have to come down, but electric signs "advertising the character of business" will have to be removed. This means that the signs "cafe," "bar," "saloon" and such things that have blazoned a greeting to the thirsty will have to be clothed in darkness.

SAN FRANCISCO, CAL.—The supervisors' lighting committee was advised by City Attorney Long that the City Electric Company was entitled to the contract for furnishing light and power for certain city buildings, as its bid was lower than that of the Pacific Gas & Electric Company. The committee decided to recommend to the Board that the contract be awarded. The Pacific company will be given the contract for gas and electricity for other city uses. The City Electric Company bid 2¼ cents per kilowatt hour for supplying electricity for the city hall, hall of justice, pumping station at Drumm and Commercial streets, corporation yard at 313 Francisco street, and corporation yard at Sixteenth and Harrison streets. The Pacific company's bid was 3 cents for current for lighting and 2½ cents for current for power.

POCATELLO, IDAHO —One of the most interesting features of the new depot which the Oregon Short Line are constructing here at an expense of $350,000 will be its kitchen equipment which will be electrical throughout. All the mixing, baking, and cooking in this model kitchen will be done by electricity. The only coal used about the building will be for general heating purposes. The decision to go over to electric cooking was made by the Oregon Short Line engineers after a careful investigation of practically all of the large hotel equipments using electricity in Idaho and Utah. It is quite likely that if the installation proves to be as successful as the company's engineers anticipate, that the use of electricity will be extended to their hotel service at many other points in the system. The electric power at this installation is purchased from the Great Shoshone and Twin Falls Water Power Company under a blanket contract between this company and the Oregon Short Line covering its entire system in Idaho reached by the distribution system of the Twin Falls Company.

TRANSMISSION.

SALEM, ORE.—The Rogue River Public Service Corporation has filed an application with the state engineer for a permit to develop power on the headwaters of Rogue River.

SANTA BARBARA, CAL.—Work on construction of a power line to Carpinteria is to begin at once, the Santa Barbara Gas & Electric Company agreeing to complete the line within thirty days.

TULARE, CAL.—The Tulare County Power Company has authorized an issue of $1,000,000 in bonds for extensions. One of the principal developments will be the construction of a new hydroelectric plant in the foothills east of Porterville, for which plans are now being drawn.

LOS ANGELES, CAL.—The finance committee has decided to recommend that $1,500,000 worth of $6,500,000 power bonds be issued. Of this amount $1,250,000 will be used to complete the city's aqueduct power plant in San Francisquito canyon, and installing a transmission line to the boundary lines of Los Angeles, and the remaining $250,000 for preliminary work in connection with condemnation of necessary private distributing systems, etc.

VISALIA, CAL.—The Mt. Whitney Power & Electric Company has connected the pressure pipe with the regulating reservoir at Kaweah No. 3 plant, thereby completing it. The plant has been in operation for over a year, but this regulating reservoir, which was excavated from the steep mountain side in almost solid rock, has been a rather slow operation and has only just been completed. This reservoir will

regulate the daily fluctuations of load. The last of the steam plant extension has also been installed, and the new substations at Exeter, Delano, Strathmore, Earlimart, Terra Bella and Packwood are completed.

LOS ANGELES, CAL.—The state supreme court has affirmed the decision of the Los Angeles superior court in the case of Pinney & Boyle Company versus the Los Angeles Gas & Electric Corporation. The Pinney Company had entered into a contract with the electric company, whereby it was furnished with electricity for power at a certain figure. Subsequently the city of Los Angeles fixed a rate for the electric company to charge its customers which was a higher rate than the Pinney contract rate. Thereupon the electric company demanded of the Pinney Company the higher rate, which the latter refused to pay. Upon this refusal, the electric company refused to deliver electricity to the company. The Los Angeles court favored the electric company on the ground that it was a public utility and could not discriminate between customers.

TRANSPORTATION.

SAN DIEGO, CAL.—Bids of the San Diego Electric Railway Company for franchises on F and Laurel streets have been accepted by the city council. The F street franchise is for the operation of a line from Third to Arctic. The Laurel street franchise is from Fifth to First street.

OGDEN, UTAH..—P. D. Kline of the Ogden Rapid Transit Company states that the contracts for all materials for the construction and operation of an electric extension into Cache Valley, have been let and that building operations are progressing in Cache county, extensions being both north and south of Logan. The contracts include ties, rails, cars and appurtenances.

DIXON, CAL.—Rails are being laid from the south towards Dixon on the first unit of the Sacramento Valley Electric railroad of twelve miles from the junction with the Oakland, Antioch & Eastern to Dixon and the grading has been completed to the outskirts of this city. With the completion of the long bridge across the slough near the Brown place, tracklaying on the remaining eight miles will progress rapidly.

FRESNO, CAL.—Plans for the extension of the Fresno Interurban Railway became known when J. B. Rogers, president of the Fresno Interurban, admitted that he had received offers of substantial bonuses from owners of property in the Gould Colony and west of Blackstone avenue to extend the new electric railroad to and through that property. The proposal calls for the extension of the line along Fresno avenue to Mahoney avenue, and thence along or parallel to Mahoney avenue to or near Blackstone avenue, and through the Gould Colony. The distance from where the line now ends on Fresno avenue to the proposed terminus in the Gould Colony is approximately 2½ miles.

SAN FRANCISCO, CAL.—The Mercantile Trust Company began suit in the superior court last week against the defunct Geary Street, Park & Ocean Railroad Company, (the old Geary street cable road), for the foreclosure of the mortgage held by the bondholders on the real estate and securities of the corporation. The action was brought by the trust company as trustee of the deed of trust on outstanding bonds amounting to $484,000. The principal assets of the company consist of the property at Buchanan and Geary streets, on which there was an office building, and the car house at First avenue and Geary street. It is set forth that the assets will not amount to more than $270,338.01, while the liabilities are $326,000.

LOS ANGELES, CAL.—A major surgical operation, by which two parallel lines of railroad are to be made one, and trackage abandoned whose initial cost was $1,200,000 was decided on at a conference in this city between officials of the Las Vegas and Tonopah, and Tonopah & Tidewater Railways, which was the Bullfrog & Goldfield. The two roads were built when the Goldfield-Tonopah district was in full bloom, but when the mines began to show disintegration, it was found that one line was not really needed. As now planned, it is stated that about half of the roads between Goldfield and Beatty will be abandoned, and the remaining segments hooked together. The ownership of the new road is a knotty problem, not yet fully determined.

SAN FRANCISCO, CAL.—The discussion of the proposed purchase of the United Railroads by the city, before the Commonwealth Club at last week's meeting, developed the fact that valuation will be the final question to be decided, and that it will have to be determined by the rules governing operation of a car system. President Lilienthal reiterated the statement that he believed the only satisfactory solution of the transportation problem was for the city to purchase the properties of the United Railroads. He instanced the charter limitations that made it impossible to interest outside capital upon which the company was dependent for extensions and improvements to its system. He then cited the following figures: Gross earnings of the United Railroads for 1914, $8,750,000; expenses, $4,900,000; net earnings, $3,850,000. While he did not carry out this mathematical problem, engineers in the audience were quick to see that was 5 per cent interest upon approximately $77,000,000. Continuing in the same strain, Lilienthal said that if the same ratio were continued for earnings and increase in population for the remainder of the term of the company's franchises, the gross earnings would amount to $306,000,000, the expenses would amount to $198,900,000, leaving an estimated net balance for stock and bond holders to amount of $107,000,000.

TELEPHONE AND TELEGRAPH.

DOUGLAS, ARIZ.—Construction of a telegraph line from Bavispe River towns to Oaxaca and Nacozari is proposed by the Sonora state government for the immediate future. Proposed owners along the line, approximately 150 miles, have been notified to purchase and set up poles.

ALAMEDA, CAL.—Refusing to accept a 20 year franchise in return for 2 per cent of its gross receipts and 40 free telephones, the Pacific States Telephone & Telegraph Company has asked the city council for a 25 year franchise. The company promises to give the 2 per cent demanded, which, it is estimated, will total $70,000 for the quarter century; 20 free phones, which is estimated to be worth $36,750; contracts for poles and fire alarm wires, $5000; not to charge for service given free since the old franchise expired, amounting to $2500 and to give the city $2900 as the 2 per cent of the revenue since the old franchise expired.

WATERWORKS.

SANTA CRUZ, CAL.—The council voted to call a bond election for $150,000 for the purpose of extending the municipal water system.

PARIS, IDAHO.—An ordinance has been passed providing for the issuance of $4000 worth of municipal coupon bonds for the construction of municipal waterworks.

BILLINGS, MONT.—An election will be held June 27th to vote on a bond issue in the sum of $450,000 to buy the present water plant and make needed improvements.

EUGENE, ORE.—Coburg has issued $13,500 worth of bonds to buy the water system and to extend the mains. The bonds have been awarded to the Eugene Loan & Savings Bank.

YUBA, CAL.—The contract for the pumping plant for Reclamation District No. 1001 has been awarded by the trustees of the district to the Electric & Machine Equipment Company of Stockton for $35,799.

GLENDALE, CAL.—A recent mass meeting of Glendale citizens resulted in the adoption of a resolution to call an election to vote bonds in the sum of $165,000, the aggregate cost of the present water plants of Glendale, for the purchase of the plants.

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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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THE SUPERB SOUTH GARDENS OF THE P. P. I. E.

ELECTRICAL DEMONSTRATIONS.
BY ERNEST LEROY ARNOLD AND DAVID BEARD MUNROE.

ADVANTAGES OF COMMISSION CONTROL
BY JOHN A. BRITTON.

P. P. I. E. MACHINERY EXHIBITS.

THE LIGHTING FIXTURE SITUATION.
BY CHAS. G. BAILEY.

INVESTIGATION OF INDUCTIVE INTERFERENCE.
BY F. E. PERNOT.

PANAMA CANAL HYDROELECTRC DEVELOPMENT.

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THE SUPERB SOUTH GARDENS OF THE P. P. I. E.

In no part of the Exposition will the lighting be shown to better advantage than in the magnificent South Gardens which are flanked on the one side by facades of the various palaces and the huge Tower of Jewels, 435 ft. high and on the other by a wall of massed pink asters. At one end is the green and gray "stone" Palace of Horticulture with its immense glass dome radiant with reflected light-tones, and at the east end, the Festival Hall. The strains from the large organ in this building will fill the gardens with harmony throughout the day and night.

A feature of the illumination system of the Panama-Pacific International Exposition to be held in San Francisco in 1915, will be its apparent simplicity and the quiet refinement of its beauty. Garishness will be absolutely "taboo" and instead of millions of yellow, red and blue incandescent lamps being exposed to view, the palaces will be flooded with a pure white light while the gardens will be lighted by the rays of hidden searchlights.

At former expositions it has been the custom to outline the buildings with rows of incandescent lamps which eliminated the high lights and shadows and presented the appearance of strings of blinding light.

Under the flood-lighting system in use at the Panama-Pacific International Exposition huge standards have been placed along the walks facing each building and shielded by banners on all sides except the one opposite the facade of the palace. The light from these will throw the architectural features of the buildings into relief and the natural shadows will be accentuated by means of purple-dipped hidden lamps behind the pillars.

The South Gardens lie between the main group of exhibit palaces that face north upon San Francisco and the huge flowered wall that marks the boundary of the grounds upon the south. The site of the exposition extends east and west for a distance of fifteen thousand feet, almost three miles, and is located just inside the famous Golden Gate entrance to San Francisco harbor from the Pacific Ocean. The Exposition opens February 20, and closes December 4, 1915.



South Gardens and Main Entrance at Night.

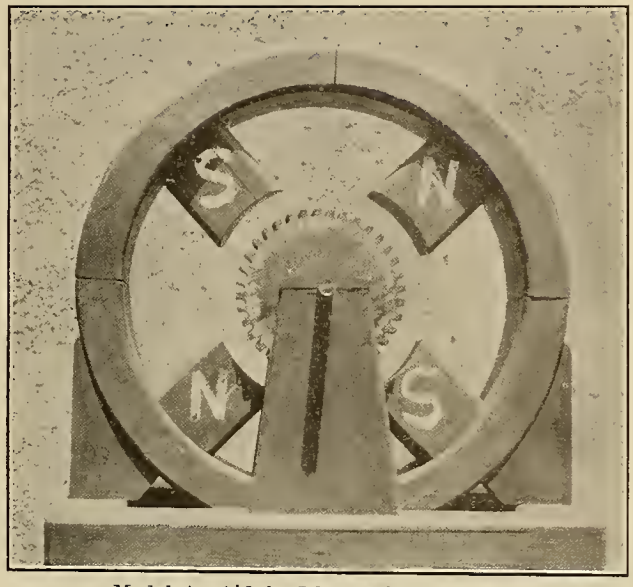
ELECTRICAL DEMONSTRATIONS.

BY ERNEST LEROY ARNOLD AND DAVID BEARD MUNROE.

(These demonstrations for class room work were presented as a thesis to the University of Southern California for the degree of Bachelor of Science in Electrical Engineering, and delivered as a paper at the last meeting of the Los Angeles section A. I. E. E. by the authors.—The Editors.)

This thesis was undertaken at the suggestion of Professor Nye and has been an endeavor to present by means of models demonstrations and suggestions some of the various fundamental ideas met with in the discussion of electrical subjects.

With this idea in mind a circular letter was prepared and sent to some fifty different engineering schools in the country stating the purpose of the thesis and inviting their co-operation in suggesting what they may have used along this line. In this manner we hoped to obtain several ideas to be worked out and constructed by us and put in thesis form. However, but little information was obtained and so we were thrown on our own resources and have succeeded in collecting the following demonstrations.



Model to Aid in Illustrating Problem.

This idea is a new one here and perhaps some of next year's senior class will take up the work where it has been left and, by noting the difficulties and setbacks encountered this year, be enabled to progress more rapidly and favorably until a very valuable and instructive collection can be gathered together. When this has been accomplished it is the purpose to publish the results in pamphlet form and distribute them among the colleges that they, as well as this school, may derive some benefit from this investigation.

The following pages contain the results of this year's work and as will be noticed has been divided under the head of Propositions. Each one is complete in itself although several can be intermingled and made to illustrate the same subject perhaps from a different angle.

The models have been constructed by the investigators themselves and several interesting mechanical difficulties had to be met before the ideas and theories could be applied mechanically and the model produced.

Proposition 1.

Number of windings possible. The object of this investigation was to obtain the largest number of windings that could be placed upon a convertible two and four pole model having originally 36 conductor slots and eighteen commutator segments. Also the various combinations possible using 34 conductor slots were worked out using same armature with two dummy slots, and using 17 commutator segments. A greater number of winding than here shown could be put on but only the windings which could be used practically were considered. Both front and back pitch must be approximately equal to z/p (where z equals number of inductor slots and p, the number of poles) in order that the two inductors which constitute a winding element may move simultaneously under field poles of opposite polarity. And so the front and back pitches were chosen to fulfill the following requirements.

(a) All the winding elements must be similar mechanically and electrically and they must be placed symmetrically on the armature core.

(b) Lap winding, the front and back pitch must be of opposite sign; they cannot be numerically equal as this would connect both terminals of a winding element to the same commutator segment.

(c) The total number of inductors may be any even number except in the case of slotted armature cores, in which case z must be a multiple of the number of slots.

The following results were obtained and the equations used appear above each set of front and back pitches:

Two-Pole.

Front pitch and back pitch must differ by two.
Front and back pitch must approximate Z/2 equals 18.

Front Pitch.	Back Pitch.	Re-entrancy.
17	—15	Single
19	—17	"
—15	17	"
—17	19	"

Four Pole.

7	—9	"
9	—11	"
—11	9	"
—9	7	"

Duplex Winding.

Front and back must differ by four.

Two Pole.

15	19	Double
17	21	"
—21	17	"
—19	15	"

Four Pole.

5	9	"
7	11	"
—9	5	"
—11	7	"

Triplex Winding.

Two Pole.

Front Pitch.	Back Pitch.	Re-entrancy.
13	—19	Triple
15	—21	"
17	—23	"
—19	13	"
—21	15	"
—23	17	"

Four Pole.

5	—11	"
7	—13	"
—11	5	"
—13	7	"

Wave Windings.

Front and back alike in sign may be equal or differ by any multiple of two, average pitch nearly equal to z/p.

Simplex.

Equation:

$$z = p\,y \pm 2$$
$$36 = 2\,y \pm 2$$
$$y = 17 \text{ or } 19$$

Two Pole.

Front Pitch.	Back Pitch.	Re-entrancy.
15	19	Single
17	17	"
13	21	"
19	19	"
21	17	"
23	15	"

Four Pole.

Equation:

$$36 = 4\,p + 2$$
$$p = 8.5 \text{ or } 9.5$$

No windings.

Duplex Wave.

Two Pole.

Equation:

$$36 = 2\,y \pm 4$$
$$y = 16 \text{ or } 20$$

17	15	Double
19	13	"
19	21	"
17	23	"

Four Pole.

Equation:

$$36 = 4\,y \pm 4$$
$$y = 10 \text{ or } 8$$

9	7	Double
11	5	"
9	11	"
7	13	"

Triplex Wave.

Two Pole.

Equation:

$$36 = 2\,y \pm 6$$
$$y = 15 \text{ or } 21$$

Front Pitch.	Back Pitch.	Re-entrancy.
15	15	
13	17	
11	19	
21	21	
23	19	
25	17	

Four Pole.

Equation:

$$36 = 4\,y \pm 6$$
$$y = 7.5 \text{ or } 10.5$$

No winding.

Assume Z equals 34. K equals Z/2 equals 17, commutator bars.

In lap windings they will be same as when 36 conductors are used, in Duplex and Triplex will be changed to single re-entrancy. But in wave windings the cases that could not be wound before, can with 34 inductors.

Simplex Wave.

Two Pole.

Equation:

$$34 = 2\,y \pm 2$$
$$y = 16 \text{ or } 18$$

17	19	Single
15	21	"
15	17	"
13	19	"

Four Pole.

Front Pitch.	Back Pitch.	Re-entrancy.

Equation:

$$34 = 4\,y \pm 2$$
$$y = 8 \text{ or } 9$$

7	9	Single
5	11	"
9	9	"
7	11	"

Duplex Wave.

Two Pole.

Equation:

$$34 = 2\,y \pm 4$$
$$y = 15 \text{ or } 19$$

15	15	Single
17	13	"
11	19	"
19	19	"
17	21	"
15	23	"

Four Pole.

Equation:

$$34 = 4\,y \pm 4$$
$$y = 7.5 \text{ or } 9.5$$

No winding.

Triplex Wave.

Two Pole.

Equation:

$$34 = 2\,y \pm 6$$
$$y = 14 \text{ or } 20$$

Front Pitch.	Back Pitch.	Re-entrancy.
13	15	Single
11	17	"
19	21	"
17	23	"

Four Pole.

Equation:

$$34 - 4\,y \pm 6$$
$$y = 7 \text{ or } 10$$

7	7	Single
5	9	"
9	11	"
13	7	"

The total number of windings that can be wound on model with 36 inductors and 34 inductors equals 92.

(To be continued.)

Electricity direct from coal has been produced by a German inventor, Johannes Marschall, of Dresden, who recently patented an application of the well known principle of the thermopile to the practical production of electric light without the intervention of boiler, engine, or dynamo. Nearly a hundred years ago it was discovered that two metals joined at one end and made hotter than the junction at the other end would generate a current of electricity through the metals. But the amount of electricity made by one such combination is always too small for practical use in lighting. The present inventon consists of a furnace containing a series of such thermopiles made of heat resisting metals, and is said to deliver a practical lighting current for a somewhat less fuel cost than the best steam engines. The first cost of the plant should also be considerably less. Elimination of the middle man, the favorite panacea for reducing the cost of living, is but an idle dream compared with the elimination of middle processes between coal, the original source of most of our power, and the usable power or electricity itself. There is a certain mathematical relation between heat and power, whether expressed as horsepower or kilowatts. If it were possible to turn into power all the heat contained in a pound of good coal it should theoretically produce 5½ h.p. or 4 kw.-hr. But in the roundabout way we now extract this power, we lose at every point, getting no more than 70 per cent of the total through the boiler, 30 per cent of this through the engine, and 90 per cent of the engine power into electricity, finally realizing in electricity less than one-fifth of the whole force of the coal, say three-fourths of a kilowatt hour. Thus there is a theoretical possibility to do five times as much with a pound of coal as is now being done.

PUBLIC POLICY OF PUBLIC UTILITY CORPORATIONS

ADVANTAGES OF COMMISSION CONTROL.

BY JOHN A BRITTON.

(In this article which was presented before the Civic Club, San Francisco, June 4, 1914, Mr. Britton points out some of the economic advantages of commission control and in doing so gives a brief history of the development of utilities.—The Editors.)

Public necessity produced public utilities. Public utilities as we know them today are of very recent origin and very young in years as the lives of men and nations are measured. It is but 104 years ago that artificial gas was first manufactured and distributed; 80 years ago since the first steam railroad was operated for public service; 50 years ago since the telegraph became an actuality; 30 years ago since the first introduction of telephones commercially.

Contemporaneous with telephones came the first introduction of electric lighting Electric lighting, however, as we know it today in the general use of incandescent lamps was not a commercial possibility until after 1890, but 24 years ago. The development of hydroelectric high tension long distance transmission dates practically from the year 1900, or but 14 years ago. Propulsion of street cars by means of electric motors reached its present state of excellence not over 20 years ago. It may, therefore, safely be said that not until the congestive conditions of urban and interurban life demanded it were public utilities more than a negligible quantity from both economic and utilitarian points of view.

The exploitation of public utilities in their initial stages called for comparatively little capital, and as the conveniences of these public utilities provoked continued increased uses, the public were willing to pay top notch prices for luxuries, even as they are disposed today to do in matters and things beyond the operations of public utilities.

From these rates as originally charged tremendous profits were derived, and the active financial minds of the earlier days taking advantage of public necessities, or the desire for the new found luxuries, derived for themselves and their associates tremendous profits from the undertakings, for as the demand increased the necessity for greater amounts of money became apparent to meet the varied uses of all of the commodities furnished to the public, and to meet the great transportation problems of transfer of peoples and merchandise from one end of our nation to the other.

Opportunities were thus afforded to financiers in the great demand for money to meet the growth of population to create for themselves and their associates plans which would give to them an undue share of the tremendous profits existing, and therefore as the demand increased by the multiplication of peoples and the opening up of new territories, the burden upon the consumer became more and more apparent, until the cries of the consumers reached the ears of legislators, and then it became necessary for legislation to properly take care of the interests of the public being served by utilities.

The first positive legislation on the question of regulation in the United States originated in the state of Massachusetts, celebrated for its very conservative control not only of public utilities, but in fact control of all corporations doing business in that commonwealth. It made its way in a modest unassuming manner and, excepting to correct very positive evils, at no time exercised drastic control, nor has it up to the present time, excepting in the preservation of the integrity of the securities and properties of the utilities dominated by it.

Other states taking advantage of the Massachusetts law, and its splendid effect on the securities of corporations in that state, began to adopt similar laws, although modeled after more progressive lines and more corrective of evils, which were continually occurring to the prejudice of the public served.

Our own state of California was slow in following the lead of other states, although public service corporation men, seeing the good effect of same regulation in other states, were continually asking for the creation of a board of control. Unfortunately,the experience of early Californians with the railroad commission of this state did not give it the confidence that it should have in commissions to regulate corporations.

As early as 1890 I advocated, in the press in Alameda county, the creation of a commission to take care of public utilities other than railroads, and with such influence as I possessed endeavored to secure a state legislation to that end for years thereafter. The time, apparently was not ripe and efforts failed. These efforts were predicated upon the unsatisfactory conditions arising from the constitution under its provisions as adopted in 1879 and amended in 1884, wherein by Article XI, Section 19, full power was given to all utilities to operate in cities without any grant of franchise other than the constitutional grant, and subject only to the provision that the governing body had the right to fix the rates. There were very few of the governing bodies that assumed that prerogative, perhaps due largely to the fact that rates were not exorbitantly high, and competition became more and more positive, although as a rule detrimental and destructive. There was a maintenance generally until about 1900 of high rates in electric service, until the production of cheap oil in quantities about that time made possible reduction in the price of steam generated current and of gas without any very great reduction in the profits, and matters lay dormant.

In the year 1907, in a paper read before a technical society on the Pacific Coast, I advocated very strongly corporation regulation. I quote from the paper read:

The day has gone into the night of darkness when reasonable far seeing and deep thinking corporation men object to the proper regulation of corporations. Regulation is needed for protection, for without it each corporation will be at the mercy of as pitiless a pack of howling destroyers as would a lonely traveler on the Siberian steeppes be against a band of gaunt and hungry wolves. Aggregation of wealth centralized becomes too great a power for evil to be permitted to exercise its own prerogatives. Commissions created in the states of Massachusetts, New York and Wisconsin have restored confidence in corporations, and have restored the confidence of investors in that they set the mark of peace on the distracted brows of the public, and have made it possible to insure an earning capacity on money invested.

This was over five years before regulation was secured.

Aside from the feeling that corporation regulation was a necessity, was the feeling that the existing method in California was ineffectual in regulation of prices for services. Committed to the tender mercies of a board of supervisors or a board of trustees or council, the companies had to face petty grafting, local political situations, and trust affairs involving millions in the hands of men whose understanding was limited to relation of cents and not millions. The hearings had before governing bodies of the various municipalities of any valuation of property or any proper rate of return were very loosely and arbitrarily determined upon, and gave rise to graft, dishonesty and dishonor.

In the hands of an appointed body of men equipped with forces to legally, technically and scientifically work out the problems presented, there is a greater certainty of a conclusion being arrived at in an orderly, legal and logical way than by any other means. The technicalities of court trials, to which utilities have been driven by the confiscatory findings of municipal bodies, are done away with in the court of the common people called "regulatory bodies."

The reason why the public utility man who desired only justice in the protection of his property is in favor of regulation, is covered by the above reflections on past methods of non-regulation, but there are greater and stronger principles involved.

A public utility cannot out of the surplus of its earnings provide sufficient capital for the extensions required in any growing community. It must look to the world at large for such money as may be necessary. The people who supply this money are known as investors, and they need, much more than the utility actually needs, the protection of regulation. What blood is to the body, that capital is to the utility. A healthy flow of blood makes life, vigor and growth; to the utility it makes all these things, with good service to the public and employment for the artisan and laboring man. Reversed, an anemic condition results, destructive, to the body politic and body corporate.

The new investment of money in a growing territory never ceases. In our own enterprise in 7 years the company has taken over 166,000 new consumers, and spent a total of over $34,000,000, or about $210 per consumer.

Reverting to the investor, he is a free agent in the disposition of his capital, and it must be coaxed and reasoned out of his pocket. With thousands of other utilities and business enterprises coaxing and reasoning at the same time, the far away voice of the California utility must make itself heard in the general clamor for money, and unless it strikes the key of confidence in the investor, its siren song will be of no avail.

The railroad commission of the state of California has done in two years more to inspire the investor with confidence in California securities than all of the gilt edge promises of promoters in the years past, and more than the attraction of the added intangible investment in the way of stock bonuses and bonds offered delivered in the past at the sole cost to the promoter of only printer's ink. The commission, in common with all other commissions, has taken the stand that the money of the investor, as long as it behaves itself and is devoted to the public good, shall and must be protected against reckless and improvident competition.

Public utilities are vastly different from those who dispose of merchandise. If the merchant is confronted with unlivable conditions he can load his stock into cars and move to other places. A public utility, once having taken up an abode must abide by whatever happens to it. It can under proper regulation be allowed to earn only a fair rate of return. The public may profit temporarily from competition between two utilities, but if unrestrained competition is permitted, one or both must go to the wall.

The prevention of such contingencies and destruction of capital is one of the greatest works of a commission and of regulation, and I am happy to be able to say that it has been the dominant note of the commission of this state. While it may take some education to impress the people with the fact that the commission is working to the ultimate profit of the consumer, it is bound to be realized here as it has been elsewhere under honestly directed efforts.

There is no question but a regulated monopoly is above all things the only factor that will inspire investors with confidence, and it is up to the commissions having chage of regulation to create that inspiration. There can be no certainty that one corporation management may continue during the life of securities offered, so as to insure the integrity of the same. Regulation under commission form is a certainty that management will continue the same, because it so regulates the issuance of securities, etc., as to prevent mismanagement.

The requirement of the commission that detailed explanation should be made of all requests for expenditures of capital, and with that the submission of plans and estimates, are provocative of careful consideration of investments before submission to such a scrutinizing body. The commission holds in that respect the position of trustee to the investor, and safeguards his interests by an earnest and unprejudiced consideration of the needs and wants of the community as reflected by the expenditure of the corporation, and is a guarantee beyond any question of the honest expenditure of funds so allowed.

Recent disclosures of the affairs of one of our largest railways clearly indicate the necessity for safeguarding the application of capital and the Eastern railway system under the proper regulation which should have ensued could not have paid $11,000,000 for property worth only $5,000,000.

Careful consideration in regulation goes in the survey of accounts of utilities, and aside from seeing that capital accounts are not overcharged, makes an adequate provision for maintenance and depreciation.

There is not a manager of a public service corporation in this or any other state who honestly administers his property, but should encourage and defend the policy of state regulation over his business, so that in the end not only his corporation, but the public, will be adequately, efficiently and honestly served, and with the confidence that must come from the public to the commission, so will confidence in the public utility serving the people be reflected.

P. P. I. E. MACHINERY EXHIBITS

THE G. E. HOME ELECTRICAL.

An attractive feature of the General Electric Company's large exhibit at the Panama-Pacific International Exposition, which will be held in San Francisco next year, will be the "Home Electrical," occupying a conspicuous place in the Manufacturers' Buildings. Besides adopting all the practical ideas previously used in various electrical houses for exhibition purposes this model home at the world's greatest exposition will be the first of its kind to be specially designed and built for the purpose by a skilled architect. It will be an electrical home in every sense of the word inasmuch as the exhibit will include the electrification of the house, garage, workshop, laundry, creamery, etc. All the practical electrically operated labor saving devices suitable for use about the home will be shown in actual service. The "Home Electrical" be a full sized house, of the attractive California-Spanish type, much the same as the Western home of an American family of moderate means. It will consist of a living room, a dining room, breakfast room, bedroom, bath, kitchen, laundry and sewing room. Nearby will be located the electrical garage, the workshop, creamery, etc. The rooms will be suitably decorated and attractively furnished. The plans call for an interior arrangement along the most approved modern lines designed to make housekeeping easy, so the necessary work can be done without wasted effort or lost tiime. Each room will be equipped with practical labor saving and comfort promoting devices operated by electricity.

The electric wiring of this building will be along the most approved lines and the electric lighting will be entrusted to an illuminating engineer. The Mazda lamps will be installed to give an even distribution of light in all parts of the house with no wasted energy, no dazzling flame points, no brilliant glare or heavy shadows.

The kitchen, where most of the housework is accomplished, will be provided with an electric range for all cooking purposes, and with electrically driven machines for peeling vegetables, polishing silver, freezing ice cream, driving cake and dough mixers and doing other necessary work. In the electric laundry the clothes will be washed by electric power and ironed with electric flatirons. In striking contrast the adjoining room will have an electric refrigerating plant of household size where the same form of energy used for heating and cooking will produce low temperatures for preserving food stuffs and for making artificial ice.

The dining room will be arranged to show how light lunches and suppers can be cooked with the electric chafing dish, or the electric grill, on the table if desired. This same cooking equipment may be utilized for preparing the morning meal in the adjoining breakfast room. The sewing room will be equipped with a motor-driven sewing machine, a small fan and an electric pressing iron suitable for attaching to the light socket. Even the bedroom will have its modern electrical appliances—a small fan, electric lights, heating pad and baby milk warmer.

In connection with the Home Electrical, and as a part of the exhibit, will be shown a garage with an electric runabout, battery charging outfit, etc. Adjoining the garage is to be located a small work shop, completely equipped with electrically driven tools. And, for the benefit of those who live outside the cities and larger towns the use of small motors on the country place will be illustrated by a model dairy room with cream separator, churn, bottle washers, water pumping station, and other small motor-driven machines such as are used almost daily on every country place.

THE NEW LONDON SHIP AND ENGINE COMPANY.

One of the interesting features of the machinery exhibits will be found to be that of The New London Ship & Engine Company of Groton, Conn.

The exhibit of the company will consist of one 180 h.p. six cylinder, four cycle, single acting, heavy oil engine, working on the Diesel principle, and the engine will be direct connected to some mechanical appliance for absorbing power, such as a pump or generator.

The bore and stroke are respectively 9 and 12½ in. and the normal revolutions 350, at which speed the engine develops slightly over 180 h.p.

The starting of the engine is obtained by means of compressed air with starting attachments on three cylinders. As soon as started the remaining three cylinders begin to fire on oil after which, when the starting gear is thrown out, the other three cylinders also begin to operate on oil.

Governing is obtained by means of centrifugal weights placed in the flywheel and controlling the fuel pump through a series of mechanisms.

An air compressor is placed on the forward end of the engine and is used to supply air for spraying the fuel into the cylinders, and for storing air for starting purposes.

This compressor is driven by a crank on the main crankshaft, and has two compressing stages in tandem. It compresses up to 1000 lb. per sq. in. Two camshafts are used, one on either side of the engine geared to the main shaft. Large size cams are used for operating levers transmitting the motion to the valves. The cylinders and head are cast in one, with the valve chests for the inlet and exhaust valve arranged horizontally. The spray valve is vertical. This arrangement of head gives an ideal form for combustion, and also ample area for valves.

The circulating water for this engine is supplied by either a plunger or a centrifugal circulating water pump. The lubrication for all bearings is obtained by the mechanical lubricators attached to the engine.

Visitors to the exhibition will thus be able to see the engine in operation, and as there will probably be Diesel engine plants of other makes running at the same time, to compare the relative features of each different design.

OFFICIAL CLASSIFICATION OF P. P. I. E. MACHINERY EXHIBITS.

(Concluded.)

Class 454. Condensing apparatus: surface and jet condensers; air pumps, dry vacuum pumps, circulating pumps; cooling towers, cooling systems.

Class 455. Methods and appliances for testing and recording the performances of engines, turbines, boilers, condensers, their auxiliaries, and other machinery: pyrometers, steam thermometers, calorimeters,t steam meters, CO_2 recorders, flue gas analysis apparatus for steam power plants; counters, gages, indicators, tachometers, and dynamometers.

Internal Combustion Motors.

Class 456. Internal combustion engines, gas turbines, and all motors in which internal combustion of the fuel takes place; apparatus and systems for supplying fuel for internal combustion motors.

Note:—This group does not include motors attached to mobile devices (such as automobiles), nor does it include agricultural or road making machinery.

Hydraulic Motors.

Class 457. Impulse wheels, turbines and other motors driven by water power, and apparatus for their regulation and control.

Class 458. Motors operated by heated air, or other means, not elsewhere classified.

General Machinery and Accessories.

Class 459. Appliances for handling heavy weights; overhead traveling and stationary cranes, operated by hand or power; hoisting engines, jacks, differential pulleys. (Marine and mining equipment not include.)

Class 460. Conveying machinery; belt, bucket and movable table or roller conveyors; trolley conveyors. (For special apparatus in mining see Classes 750, 756 and 780.)

Class 461. Power-transmitting appliances; leather, fiber, chain, link and other belting; cable and rope drives; gearing, shafting, couplings, pulleys, clutches, hangers and pedestals.

Class 462. Apparatus for lifting and handling water and other liquids: hand, steam and power driven pumps, pulsometers, air lifts, hydraulic rams; water pipe and accessories; water meters. (See also Classes 451, 470, 530, 554, 559 and 751 for pumps for special uses.)

Class 463. Fire engines, extinguishers and fire fighting apparatus. (See Class 183.)

Class 464. Air and gas compressors and accessories. (See also Classes 354 and 749.)

Class 465. Brick and tile making machinery. (Transferred to Class 765.)

Class 466. Dredging and excavating machinery and appliances. (For railroad machinery see Class 520. For mining machinery see Class 759.)

Class 467. Refrigerating machinery. (See also Classes 531 and 601.)

Class 468. Packing, gaskets, heat insulating material, lubricators, lubricants, lubricating systems, metal for bearings.

Class 469. General machinery not otherwise classified.

Tools for Shaping Wood and Metals.

Class 470. Steam forging hammers, hydraulic forging presses; hydraulic accumulators, intensifiers, pumps and accessories; extruding presses; hand and power shears, punches and blank cutters for metals; plate bending and planing machines; drop forging hammers; swaging presses; riveting machines. (See Class 462.)

Class 477. Special machinery for various purposes, not otherwise classified.

ELECTRICAL GROUPS.

Commutating Apparatus.

Class 478. Direct current commutating generators, all types.

Class 479. Synchronous commutating machines, comprising synchronous converters, motor converters and double current generators.

Class 480. Direct and alternating current commutating type motors.

Class 481. Direct and alternating current commutating type railway motors.

Synchronous Apparatus.
(All alternating Current.)

Class 482. Synchronous generators, all types.
Class 483. Synchronous motors.
Class 484. Synchronous condensers.
Class 485. Synchronous frequency changers.
Class 486. Synchronous rotary phase converters.

Stationary Induction Apparatus.

Class 487. Transformers (including induction coils) and autotransformers, all types.
Class 488. Potential regulators and reactances, all types.
Class 489. Induction starters.

Rotary Induction Apparatus.

Class 490. Induction generators, all types.
Class 491. Induction motors.
Class 492. Induction condensers.
Class 493. Induction frequency changers.
Class 494. Induction rotary phase converters.

Unipolar (Acyclic) Apparatus.

Class 495. Unipolar (Acyclic) apparatus.

Rectifying Apparatus.

Class 496. Rotating commutators.
Class 497. Electric valves (including mercury rectifiers.)
Class 498. Vibrating commutators.

Luminous Apparatus (Sources of Light.)

Class 499. Arc lamps, all kinds.
Class 500. Incandescent lamps, all types.
Class 501. Vapor lamps, all types.
Class 502. Vacuum lamps, all types.

Measuring, Indicating and Recording Apparatus.

(Not including instruments for pure science and research work.)

Class 503. Instruments for switchboard use.

Class 504. Instruments for mounting apart from switch board.

Class 505. Portable instruments.
Class 506. Laboratory instruments.

Apparatus for Protection of Electrical Apparatus and for Control and Distribution of Electric Energy, Other Than Railway Material.

Class 507. Complete switchboards.
Class 508. Lightning arrestors and accessories.

Class 509. Devices for opening and closing circuits and controlling flow of current therein.

Note:—In class 509 will be placed such devices as are used in stations and on main circuits.

Class 510. Devices and material used in distribution of current and control of distribution circuits other than in stations and on main circuits; including fuses and fuse holders, conduits, cables, wires, insulators, junction boxes, cabinets, cut-outs, sockets, fixtures, electric sign mechanism, and other subsidiary apparatus not otherwise classified. (See Class 308.)

Class 510½. Electrical workers' tools and appliances.

Electro-Chemical Apparatus.

Class 511. Storage batteries.
Class 512. Primary batteries.

LIGHTING METHODS

THE LIGHTING FIXTURE SITUATION.

BL CHAS. G. BAILEY.

(This article which presents ably the lighting fixture situation also contains many suggestions for the way out from present difficulties and undesirable conditions with the promise of raising the lighting fixture business to the plane of a profession.—The Editors.)

What is our business coming to?

Perhaps in no field of endeavor does one hear this question raised more often than in the lighting fixture business. The poor retailer seems the helpless pawn of a fate which yesterday meant the introduction of the tungsten lamp, today is the glass manufacturer with a bewildering array of attractive offerings and tomorrow—ah, if you and I were only sure just what was to be, wouldn't we quickly throw the sheet over the humble remains of yesterday and today and strain our credit and the capacity of our show rooms in order to acquire the thing which our friends the buying public will recognize as "the latest."

Speaking seriously, was there ever a business so full of rainbows and rainbow chasers? You know how elusive it all is. The show rooms are filled with the type of things which we are certain the public will buy —only they do not buy all of them soon enough. Then the next wave of enthusiasm breaks and in the foam on the beach, which marks the uttermost effort of the latest by someone, we see the sort of thing we and the public have long wanted. So it goes and the end is not yet.

Is it not time the Eastern manufacturer of metal and glass, the importer, the jobber and the retailer took counsel together. Who or what is to solve this unsolvable question? Can the number of Eastern manufacturers he lessened and kept down? Can the importer also be curbed? Can the profit of the retailer —enough for five say, but never for the twenty-five— be brought up to former high water marks?

Let us consider this situation in detail. Now if ever is the time ripe for a solution. At all times the retailer is the key to the situation. He it is who must dominate. He it is who must decide who shall continue to exist. Let the Eastern manufacturer be made to realize that sound credits are the basis of a healthy prosperous industry. Cause him to realize that before considering the account of a new lighting fixture firm he must know the experience and record of the man or men about to begin, and whether such an addition in that town is advisable.

The retailer looks and feels like a weak link, does he not? However, all is not lost. We cannot all start studios, but we positively must realize that we cannot be efficient in this day and age and continue to manufacture (?)—Heaven save the mark—any sort of fixture called for, from a cord drop to a bronze lobby-piece.

First decide whether you expect to go in for volume or art. Next stick to your decision. Then decide the same thing once more in precisely the same manner. Next stick to your second decision. Repeat this at frequent intervals for some time—we lighting fixture people have been in the habit of changing our honest-to-goodness set policies every few days or weeks, so it will take practice to make all these decisions come out alike. Then decide whether you expect to manufacture or buy ready made.

In case you decide to manufacture your own lighting fixtures, no one will object seriously if you first cancel this decision before finally deciding not to do so. If you experience any hesitation over this point, remember that, if you buy a thing from some one else which does not sell, you have a victim to roast, while if you have concocted the effusion yourself—but why go further?

Now that you have decided to buy your goods remember your decision to go in for volume or art, not both mind you, and buy where either the one or the other may be had. Right here comes your second lot of decisions. How many factories can our Western country support in addition to the many well organized and well equipped ones in the East? Not as many as you think—not by one-half. We haven't the population in the first place and we have the parcels post, express and freight in all the other places. Granted that you, Mr. Retailer, have decided just how many Western manufacturers measure up to this new scheme, because of proven worth and honesty in the past, it now becomes necessary for you to support these few to the limit—their limit and yours. Get a sign printer to print the definition for loyalty on the wall of your bedroom, come home early and spend some time each night in contemplation—in that room. How many times have you continued to purchase a popular seller from the same manufacturer, unless you had first proven to your own satisfaction that he was losing money on every one he sold to you?

A final point to remember—do not try to be too original. There is too much danger that one will become a purveyor of freaks rather than a seller of harmonious pieces. Restrain yourself if possible from attempts to make over every fixture offered you by the manufacturer. This will have a tendency to inculcate respect for the ideas of others and will eventually wear off the keen edge from that desire so long rampant on the Pacific Coast to create everything for oneself. After a time, with an instilled toleration, one can commence to suggest and adopt modifications which represent creative individuality. Then when one has finally learned to work easily from illustrations or photographs the final stages of the change have been reached. For we must learn, as a result of the kaleidescopic conditions of the lighting fixture business, to work less from stock and more from our catalogs. Strange as it may sound the more of this we do the higher grade of appreciation do our clients attain, while we at the same time approach our ultimate goal, keeping the profits of our business in the bank rather than in the show rooms, and broadening our business to the plane of a profession.

INVESTIGATION OF INDUCTIVE INTERFERENCE.

BY F. E. PERNOT.

(The author defines the terms used, outlines the theory of induced disturbances, and proceeds to discuss the normal interferences found as developed by the investigation of the joint committee dealing with this problem and appointed by the California Railroad Commission. This article is from a recent issue of the California Journal of Technology.—The Editors.)

A matter of more than passing interest to a large number of present day engineers, and one which is insistently demanding a solution, is that of inductive interference. Considered by itself, it is a subject which is not new—an understanding of the fundamentals involved having come coincidently with the theoretical and experimental researches of the early scientists. The problem now is a very practical one, brought about by the ever increasing complexity of the electrical installations demanded by a growing civilization.

"Inductive interference," in its broadest sense, can be understood to refer to the fact that the electrical conditions in any conductor or circuit are dependent to a greater or lesser extent upon the electrical conditions in an adjacent circuit. Considered in this way, the term might refer to many things—radio-telegraphy, the mutual action of solenoids, the effect of one wire of a three-phase transmission system upon the remaining two, and so on through both electromagnetic and electro-static conditions. In the narrower applications, this term refers to the harmful disturbances occasioned in signalling circuits by neighboring electrical activities. Ninety-nine per cent and over of "neighboring electrical activities" would, at present, be covered by saying power transmission systems. Theoretically the situation is a mutual one—the signalling circuit affecting the power circuit in the same way as the power circuit affects the signalling circuit, but when one considers relative magnitudes it requires no great effort to see that though in one case the effects are very serious, in the other they are entirely negligible. A power transmission line carrying a current of tens or hundreds of amperes at a potential difference of thousands of volts will have relatively a far greater effect upon a signalling circuit carrying only millionths or thousandths of an ampere of current at a potential difference reckoned in single volts, than will this signalling circuit have on the power system.

Due to the fundamentally sensitive apparatus used in the transmission of articulate speech—the telephone—this type of signalling circuit is subjected to by far the greatest inconvenience from electrical disturbances arising from any cause. Telegraph circuits, and in a lesser degree, railway block signalling systems are also affected.

Concerning inductive interference, then, the main interest centers around the matter of the introduction, from power distributing systems, of disturbances into telephone systems. Such interference can be broadly divided into two classes. First, those cases in which continuous and normal operating conditions of the power system render unsatisfactory a conversation carried on over neighboring telephone circuits, usually by the production of foreign sounds in the receiver; and, second, the cases in which abnormal or transient conditions of the power system render conversation impossible or endanger central office apparatus and even the operators in charge. These two cases do not occur singly; a telephone line so situated as to be affected in one case naturally is not entirely exempt in the other.

A brief outline of the theory of the induced disturbances is in order here. Induction arises from two principal causes—the electromagnetic and electrostatic fields—both of which make themselves apparent by the production of an extraneous current in the telephone circuit and therefore in the receiver.

The electromagnetic induction arises from the magnetic field set up by the currents in the power conductors. A portion of the magnetic flux produced by these currents links itself with the telephone circuit, and an electromotive force is generated therein proportional to the time rate of change of this flux. The power and telephone circuits are simply coupled by the mutual inductance of the circuits. This coupling is very "loose" due to the usually great separation, and the effect of small currents induced in the telephone circuit upon the power circuit is negligible. The currents are the result of the e.m.f. produced by the varying flux.

The phenomenon of electrostatic induction is due to the potentials of the power conductors. Surrounding the power conductors there exists an electrostatic field, and the potential of any isolated particle in the surrounding space is determined by the potential of the electrostatic field at this point. This is readily perceived when one recalls the numerous illustrations of the system of equi-potential lines surrounding a charged body. The potential of any point is determined by the equi-potential line passing through it. The two telephone wires comprising a circuit are at different positions in space and therefore, in general, are on different equi-potential lines as established by the power conductors. Consider now the situation which exists when one or both ends of the telephone circuit are connected through apparatus. The tendency then is for both wires to assume the same potential, but they can not do this without having established on them charges, or stored quantities of electricity, of a magnitude sufficient to alter the original field to the extent of placing the two conductors on the same equi-potential line. Since the power line potentials are alternating, the field is continually changing, thereby requiring changes in the charges necessary on the telephone conductors to maintain both at the same potential. These variations in charge constitute a flow of current through the connected apparatus, which then manifests itself in the same manner as a current produced by the e.m.f. of electromagnetic induction.

So much for the general theory, which, when founded on previously established physical laws is eminently simple. The mathematical problems involved become complicated when a rigid quantitative solution is desired relative to any particular case of "exposure"; but it is not this which offers the greatest difficulties. To make such a solution would necessitate the exact specification of all conditions involved by the entire system, and it is here that the matter passes beyond the possibility of mere theoretical treatment. What

are the conditions existing? What are the more general conditions which may be expected in typical cases, and what details are to be considered important and what unimportant? What can be done by the power companies and what can be done by the signalling companies to relieve already bad situations or to prevent the creation of new ones? To answer these questions which had become prominent through numerous complaints on the part of various signalling companies, a committee was appointed by the California Railroad Commission, under the title of The Joint Committee of Inductive Interference, composed of representative power and signalling engineers. It was to be the work of this committee to outline and have carried out the necessary tests to furnish material sufficient for a basis for decisions by the commission. The actual work was then placed in the hands of a testing force working together with a sub-committee on tests.

An investigation of the problem, on a scale far more extended than that of any previous work was then undertaken, work actually beginning in the last few months of the year 1912. The entire matter being pioneer work naturally required the expenditure of the greatest portion of the time on the developing of methods of procedure and in orientation—that is, in a selection of the limited number of things which could profitably be done from the unlimited number which presented themselves.

So far, it has been found, as expected, that in regard to continuous disturbances under normal operating conditions the greatest portion arises from the higher harmonics or multiples of the fundamental frequency existing in the power line currents or voltages. This is natural when one remembers the greater inductive action of high frequency currents or voltages, and also (within certain limits) the greater sensitiveness of the human ear to sounds having a frequency of vibration much higher than the customary frequency of 60 cycles per sec. Great complications in the investigation are introduced by this fact. Meter readings which indicate merely average or effective values of the current or voltage waves cannot be relied upon as giving full information. A few milli-amperes of current will give the same meter reading for one frequency as another, but the effect of equal currents in producing disturbances to conversation is a function of the frequency when used with the same receiver. The use of the oscillograph, an instrument to visualize and record photographically the actual wave shape as made up of its component harmonics, becomes necessary both in the determination of the induced currents in the telephone circuit and of the currents and voltages existing in the power system. The oscillograph, however, has its limitations in that its sensitiveness is not sufficiently great. Currents of the value of from 5 to 75 milli-amp. are required to operate it and this value of current is many times the current required to produce disturbances in a telephone receiver.

To detect, pick out and measure higher harmonics of these small magnitudes, a special scheme termed a "resonant shunt" has been resorted to. By its use, currents of a single frequency are selected by tuning in the same way as is done in a wireless receiving set. The magnitudes are derived by comparison of the volume of sound produced by the resulting single frequency current of unknown value with the sound produced by a known amount of current of the same frequency, supplied by a variable frequency apparatus—the Vreeland Oscillator. A disadvantage of this method is its slowness and the fact that a wave analysis by this method does not give a simultaneous determination of all the hamonics. However, it is the only scheme which appears feasible for such small currents.

A prolific source of trouble has been found to lie in the so-called "residual" currents or voltages. The residual current is defined as the "vector sum" of the line currents in the power system. Normally, this current would be zero—the current flowing outward in one conductor being returned by the others. In some conditions this may not be true—some of the outgoing current returning by way of the earth. This unbalanced portion of the current is much more effective in producing certain disturbances than are the currents which are balanced. The same way with the residual voltage which is defined as the "vector sum" of the line voltages to earth. Normally, this would be zero, one line potential being as much above earth potential as the sum of the others is below. Due to unbalances in the system this may not be true, and therefore the sum total would not be zero. The amount remaining, termed the residual voltage, has a relatively greater effect on adjacent circuits than do the balanced voltages. The accurate determination of these residuals is a matter of difficulty, due to their generally small magnitudes as compared with the totals involved. For example, the residual voltage of a 55,000 volt transmission line may be in the neighborhood of 100 or 200 volts; and, further, is generally of such variable magnitude as to render unsatisfactory measurements made at different times. The same applies to the residual current.

In order to determine fundamental data as regards the effects of these residuals, the power line is shut down, all three conductors connected together, and the whole then operated as a single conductor with ground return. In comparing the results of tests under such conditions with theoretical computations, large discrepancies were observed. The calculations, as originally made, were on the basis of the earth being a body of perfect conductivity which is equivalent to saying that the current returns entirely along the surface.

Working backwards, and computing the depth of the return current from the observed test data, the equivalent path of the earth return was found to be several hundred meters below the surface. While this is true for the return current, and therefore of importance in determining the electro-magnetic induction, just the reverse seems to be the case for electrostatic induction. The effect of trees, fences, towers and adjacent circuits is to exert a shielding influence which raises the equivalent earth plane nearer to the power conductors. Naturally, these two conditions are dependent entirely upon the character of the country in which the lines in question are located. This matter alone is sufficient to make unreliable any theoretical calculations of induction on new cases of exposure.

If the power system be an isolated one, the wave shapes of current and voltage will be fairly constant,

depending only on the generator supplying power and on the load apparatus. Such a case would be relatively simple of treatment as long as the same apparatus was used. However, in an interconnected system in which power is supplied by many generators in different stations, and where the character of the load is continually changing, the wave shapes are different at different times during the day. Even though all generators supplied pure sine waves, of, say, 60 cycles frequency, every piece of synchronous load apparatus present on the line would impress on the circuit such higher harmonics as were inherent in the apparatus itself. Since it is the higher harmonics which are of importance in the production of noise by induction, the complexity of the investigation work becomes apparent.

It has been found that even such inert apparatus as transformers contribute their share toward a distortion of wave shape. Impress a pure sine wave of voltage on a transformer and the current taken for excitation is not of a pure sinusoidal shape. This is due to the varying permeability of the iron core at different flux densities and is more marked the nearer the iron approaches saturation. In some cases a reduction of the flux density in the core (either by decreasing the voltage or by increasing the number of turns), as by five per cent, has affected a much greater percentage decrease in certain harmonics found present in the power line residual currents or voltages.

At the present time much study is being devoted to the subject of transpositions, both of the telephone and power circuits. By a proper scheme of relative transposition of both power and telephone conductors, the magnitude of induced disturbances can be greatly diminished and it is toward general methods for selecting the proper scheme that the study is directed. This subject is, in itself, fully as complicated as many of the previously mentioned matters. It is hoped that much can be accomplished towards an elimination of a large amount of the disturbance, occurring during normal operation, in this way.

From an investigation of the sort now going on nothing but good can follow and though the work necessarily proceeds slowly, the difficulties arising should be fully appreciated. The writer had, for some time, the opportunity of engaging in the work that is being done and can say that the whole subject is one of absorbing interest, both practically and theoretically.

A flying train is creating much interest among engineers and government officials at London, Eng. The model consists of a miniature car weighing some 40 lb., constructed of steel with an aluminum base, resting upon about 30 ft. of special track. Beneath the rails are electric coils which, it is explained, when energized by an alternating current, exercise a repelling effect upon the car sufficient to raise it a fraction of an inch above the rails. When thus suspended in the air, the car is drawn along by electromagnets, or solenoids, which span the track in the form of arches, through which the car passes. Although the model is raised above the track, four brushes attached to the car remain in contact with the rails and two other brushes make contact with an overhead grooved rail.

ELECTRICAL RESEARCH AT TECH.

The activities in electrical engineering research at the Massachusetts Institute of Technology have developed very rapidly during the past year and a noteworthy extension of the organization for administering the researches has recently been effected. This has been aided by the co-operative agreement between Harvard University and the Institute of Technology whereby the departments of electrical engineering in the two institutions were practically merged.

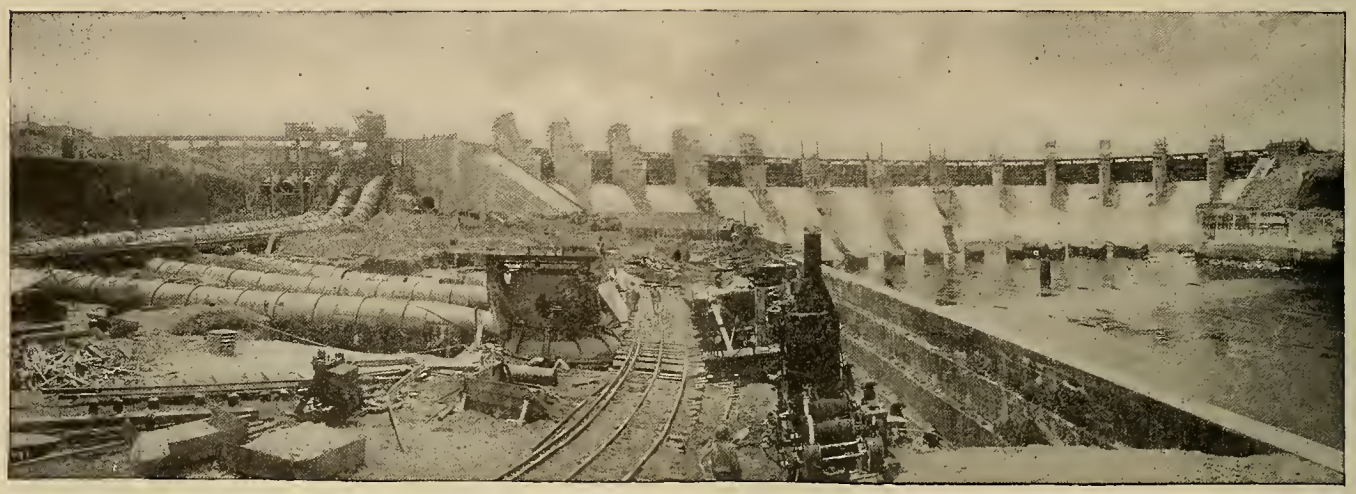
The study of a wide variety of problems has already been undertaken by the laboratory. During the past year, the collection of data upon the study of the relative economic fields for electric, horse and gasoline trucks, which was begun in 1911, has been completed; an abstract of the results of the investigation has been presented, and the final report will probably be completed early this summer. The study of the methods of handling miscellaneous freight at the Boston freight terminals, begun late in 1912, has been completed, and a paper covering the methods and results of the study has been prepared for presentation at a fall meeting of the New York R. R. Club. An extended study of the effect of the length of passenger ride on street cars upon the net return on the investment in street railway properties is being conducted; it is expected that this study will require about 5 years, during which time the revenues, expenses, and traffic data of the street car systems in a number of the large cities will be analyzed. An analysis is being made of the delivery service of a large department store in New York City, with the object of presenting information upon the factors affecting the operation of the delivery service of such department store; this investigation will be completed during the present summer. The experimental work now being carried on includes a study of the "skin effect" in solid and stranded conductors when carrying high frequency currents. In connection with this study, there have been developed methods of measuring at 5000 cycles per second a change in inductance of 10-8 henry or in resistance of 0.0002 ohm. The experimental work also includes an investigation which has for its object a more accurate analysis of sound waves than has yet been made. Other studies which will be taken up include (1) an analysis of core losses at tooth frequencies in electrical machinery; (2) a study of forced and free vibrations of loaded and unloaded telephone diaphragms; and (3) a study of transient electric phenomena occurring in a 750 mile artificial power transmission line. Apparatus has been developed by one of the graduate students for measuring the alternating current resistance of railroad rails at frequencies up to 60 cycles; measurements are to be made upon a number of tread and contact rails of different chemical compositions.

At the same time that this experimental work is going on, the Vail Library of 30,000 volumes is being catalogued. This fine library was recently presented to the Institute by Theodore N. Vail, president of the American Telephone & Telegraph Company.

PANAMA CANAL HYDROELECTRIC DEVELOPMENT.

The permanent supply of electric energy for the Panama Canal is generated in the Gatun hydroelectric station, at the Gatun spillway dam. The tremendous water storage in the artificial Gatun Lake, fed by the Chagres River, not only carries vessels the greater part of the way across the Isthmus on a level about 85 ft. above the oceans, and provides water for raising and lowering them gently through the Gatun, Pedro Miguel and Miraflores locks, but also affords an excellent opportunity to generate electrical energy for lighting the canal, for operating the gigantic gates and other locking machinery, and for the locomotives towing system.

Electric current will also be used for coal handling plants at both ends of the canal, for machine shops, waterworks, drydocks, and possibly in the future for hauling trains on the Panama Railroad. To insure continuity of service in case of accident, a steam-electric station at Miraflores, erected a few years ago to supply power for construction work, will be ready as an auxiliary to pick up the load when necessary.



Gatun Hydroelectric Installation, Under Construction, Showing Pipe Lines and Turbines Erected.

The complete equipment for the power and distribution system on the canal comprises the 7500 k.v.a., 2200 volt hydroelectric power plant at Gatun; the 4500 k.v.a, 2200 volt Curtis turbo-generator electric power plant at Miraflores for emergency; a double 44,000 volt transmission line across the Isthmus, connecting Cristobal and Balboa with the two power plants; four 44,000-2200 volt substations, stepping down at Cristobal and Balboa, and up or down at Gatun and Miraflores, depending on which of the two plants is supplying power; thirty-six 2200-240 volt transmission stations for power, traction and light at Gatun, Pedro Miguel and Miraflores locks; three 2200-220-110 volt transformer stations for the control boards at the locks; and stations at Cristobal and Balboa for the coal handling plants, machine shops and drydocks.

The Gatun hydroelectric plant is designed to develop the full water output when operating under an effective head of 75 ft. Water is taken from Lake Gatun through passages 12 ft. wide, fitted with wrought iron racks 29 ft. 7 in. high to prevent trash from entering the pipe lines. The water is admitted into the pipe lines through three 10 ft. 6 in. diameter head gates, electrically controlled and operated.

The Turbines.

The three 2000 kw. main generating units in the hydroelectric station are each driven by a special, 50 in., vertical, single runner, Francis turbine manufactured by The Pelton Water Wheel Company. Each turbine has a maximum capacity of 3600 h.p. when operating under an effective head of 75 ft. and at a normal turning speed of 250 rev. per min. The turbines are located at such a height that the center of the runners is 20 ft. above tail water.

The water is discharged through steel lined concrete draft tubes, which are 71 in. diam. at the discharge from the runners and increase to an elliptical section of 9 ft. by 7 ft at the outlets, which are horizontal, there being a 90 degree bend in the tubes. The linings are made of ¼ in. steel plates, which were fitted together in the shop and shipped knocked down.

The turbines are of the spiral case type and are fitted with heavy cast iron distance rings which carry the generators. The weight of the revolving parts of each generator and turbine is carried on a roller thrust bearing mounted on top of the generator. The turbine is so designed that the runner exerts an upward thrust of 20,000 lb. when working at full capacity, thereby relieving the thrust bearing of that amount of load.

Oil for the thrust bearing is supplied by a small pump geared to the main turbine shaft, and a tank is provided below the pump to receive the overflow from the bearing. In this way a constant circulation of oil is maintained. As this oil returns to the suction tank, it passes through the lower guide bearing on the main shaft and lubricates it.

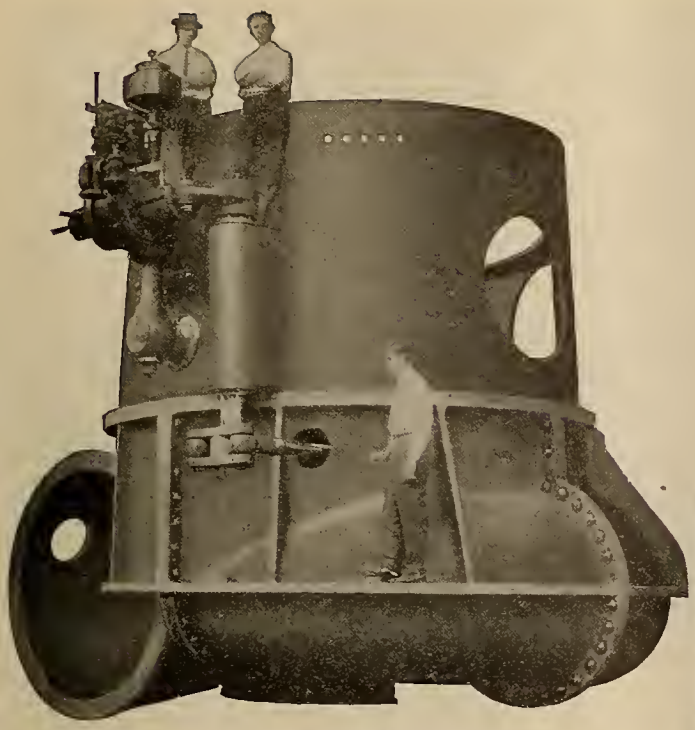
The runners of the turbines are made of a special bronze and weigh approximately 7000 lb. each. They are bored taper and held in place on the lower end of the shaft by means of bronze nuts. The surfaces of the runner vanes are all hand finished to reduce hydraulic losses.

The Governors.

The speed of the turbines is controlled by Pelton oil pressure governors, which are mounted on the distance rings and are driven by bevel gearing from the main shaft. Tachometers are mounted above the governors on supports bolted to the distance rings. The tachometers are directly connected to the governor heads.

The governors are fitted with small electric motors for varying the speed of the main units for synchronizing purposes, and a device is provided on each governor for varying the permanent drop in speed from no load to full load. This can be adjusted for any variation from 5 per cent drop to absolutely constant speed from friction load to maximum load. The governors are also fitted with hand control mechanism for adjusting the gates independent of the oil pressure.

The wicket gates for controlling the supply of water to the runner of the turbine are steel castings with hand



3600 h.p. Pelton Water Wheel Company Francis Turbine for Panama Canal Hydroelectric Station at Gatun Spillway.

finished surfaces. Each gate has its pivot stem extended upward through a packing gland and is fitted with an operating lever. All the gate levers are connected to the gate ring by means of bronze links, and the gate ring is connected to the governor rockshaft. All the regulating mechanism is therefore outside the turbine case, except the gates themselves. The water passages on each side of the gates are provided with renewable rolled steel wearing plates.

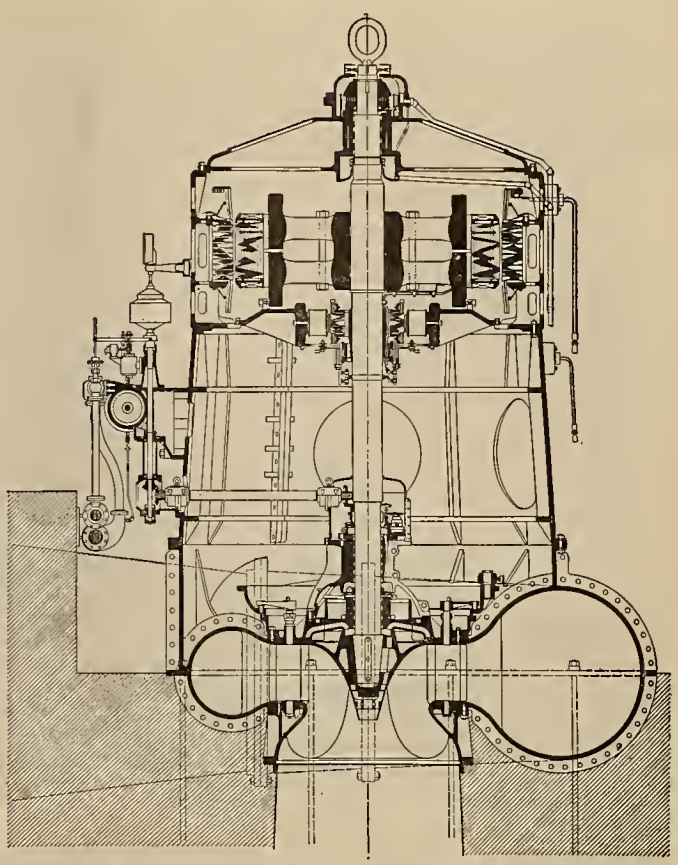
The pressure oil for actuating the governors is supplied by two Pelton rotary pumping units, driven by 10 h.p. alternating current motors at a speed of 375 r.p.m., each pump being capable of supplying the governors on all three units. The governors work on an open system, there being no vacuum chambers used. The discharge oil from the governors is led into oil sump tanks, from which it passes into the suction of the pumps. Each oil pump is connected to a steel pressure oil receiver with an air space above the oil. The oil sump tanks and pipe connections are installed in duplicate and valves are provided to enable one set to be cleaned while the other is in service.

Generators and Direct Connected Exciters.

The three main generating units are of the vertical revolving field type, each being provided with a direct connected exciter. The generators are of the General Electric Company manufacture and are three-phase, 25-cycle, with a guaranteed continuous capacity of 2000 kw. at 0.8 power factor, 2200 volts, 250 revolutions per minute, and with an overload rating of 2500 kw. at 0.8 power factor for two hours.

The exciters are of 50 kw. capacity at 125 volts, each capable of furnishing exciting current for two generators under maximum guaranteed load. Each unit, generator and exciter, weighs approximately 65 tons.

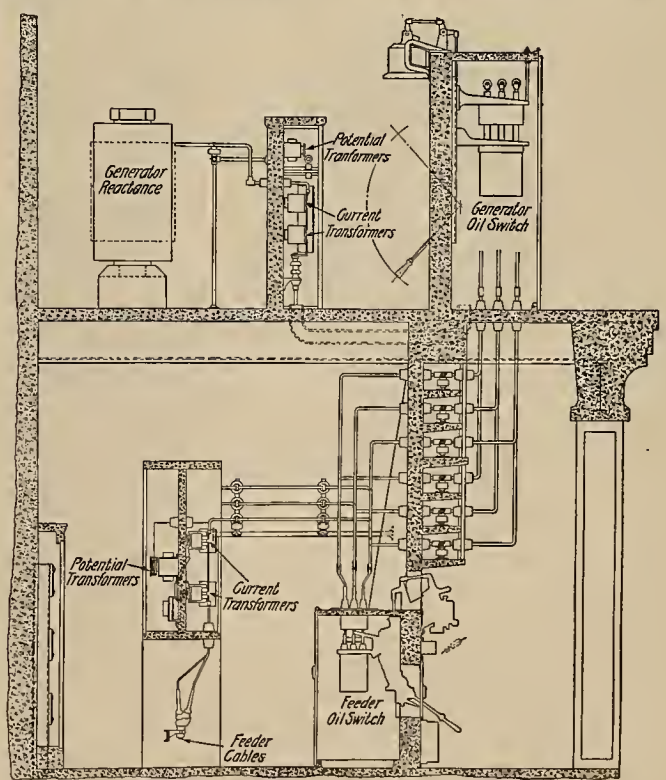
The generators, under official tests, showed an efficiency of 95.1 per cent at 2000 kw., 0.8 power factor; 94.3 per cent at 1500 kw., 0.8 power factor; and 92.5 per cent at 1000 kw., 0.8 power factor. The guaranteed temperature rises of 40 degrees C. above room temperature, of 25 degrees under continuous operation at full load and 55 degrees



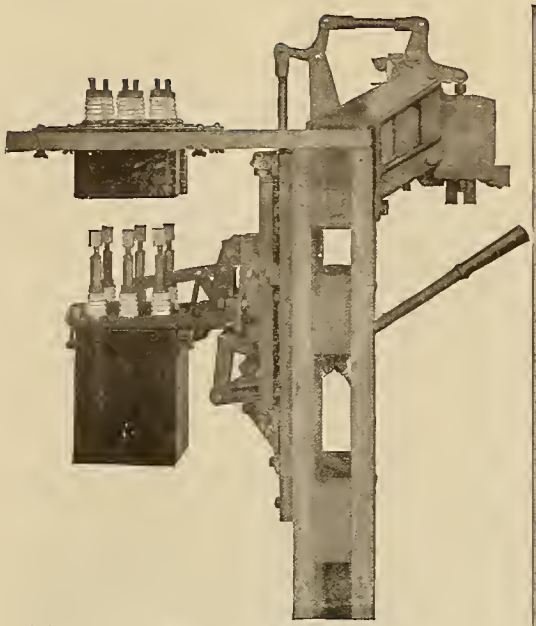
Cross Section Through Waterwheel, Generator and Exciter, Gatun Hydroelectric Installation, Panama Canal.

rise after two hours run at 25 per cent overload, were met with an ample margin.

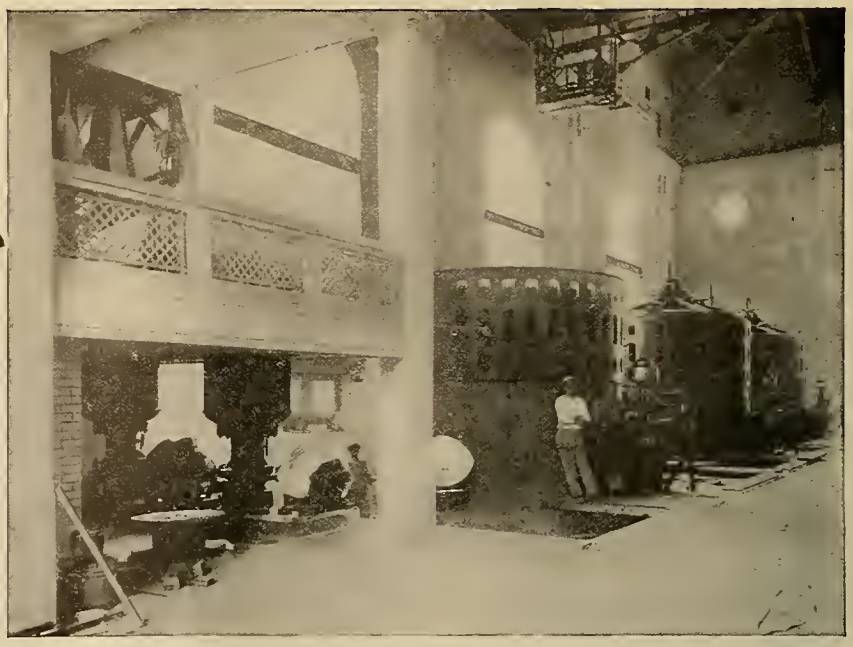
Current limiting reactances were provided to give 5 per cent reactive drop, at 2500 k.v.a., 2200 volts, 3-phase, 25 cycle. While the generator windings are sufficiently rigid



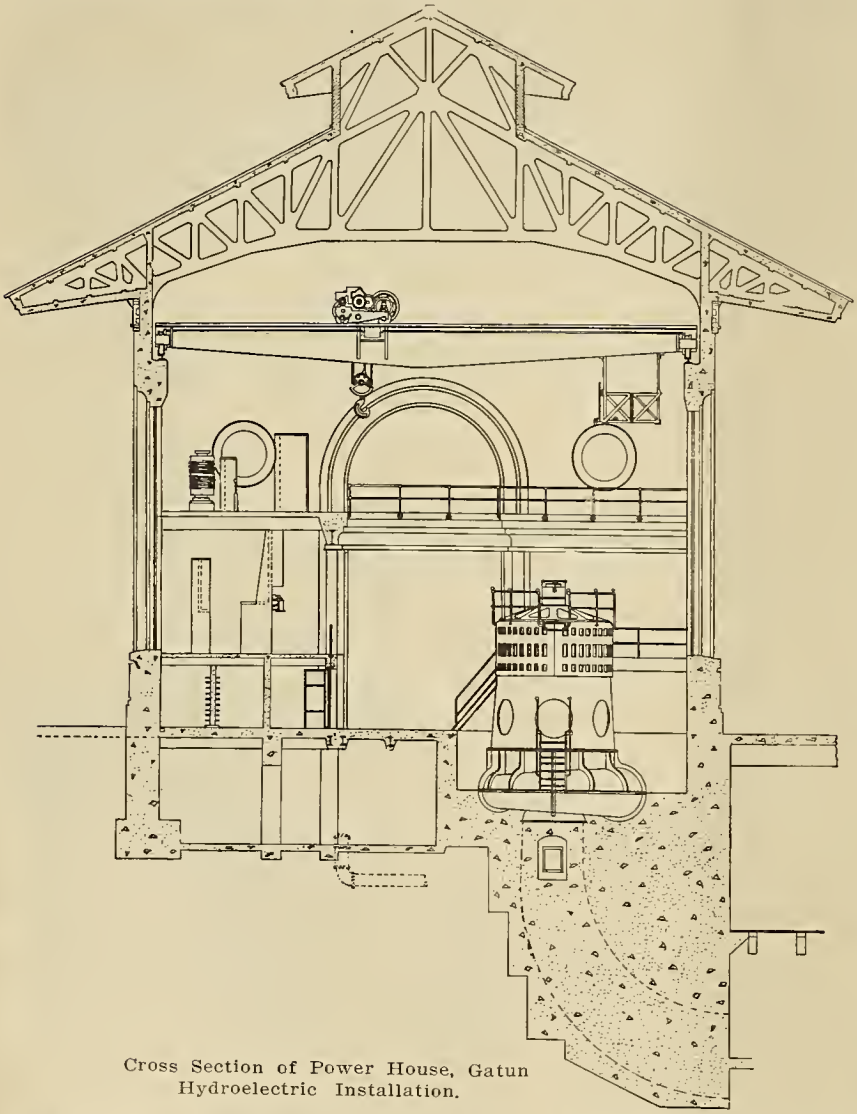
Arrangement of Switching Apparatus in Gatun Hydroelectric Station.



Triple Pole, Single Throw, 2500 Volt, 300 Amp. Oil Switch With Solenoid Operated Mechanism and Disconnecting Device Open.



Interior of 6000 kw. Gatun Hydroelectric Station.



Cross Section of Power House, Gatun Hydroelectric Installation.

to stand the strain of a short circuit under full load, these reactances will reduce the shock on the windings and will also serve to render the operation of synchronizing the machines easier and safe.

In addition to the direct connected exciters, two motor driven exciters are supplied. These consist of a 100 kw., 125 volt, 500 r.p.m. generator, direct connected to a 150 h.p., 2200 volt, 25 cycle, squirrel cage type, induction motor. They are mounted on a common base plate and provided with three bearings. These exciters can also be used for charging the control battery.

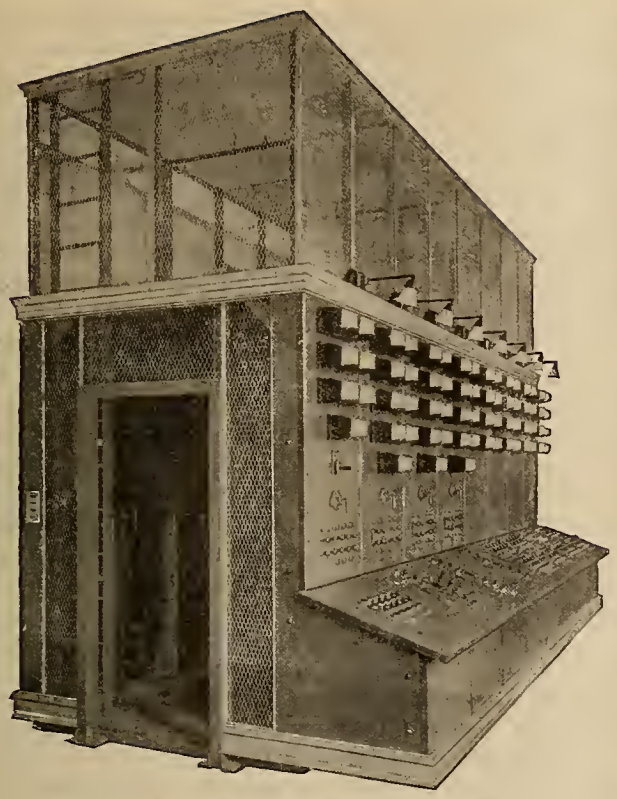
Distribution Scheme.

On account of the great distance, the current is transmitted at a voltage of 44,000 from the power stations to both ends of the canal. The step-up transformers are, however, not located in the power plants, but in substations in their vicinities; therefore, the power plants generate and distribute only 2200 volt current.

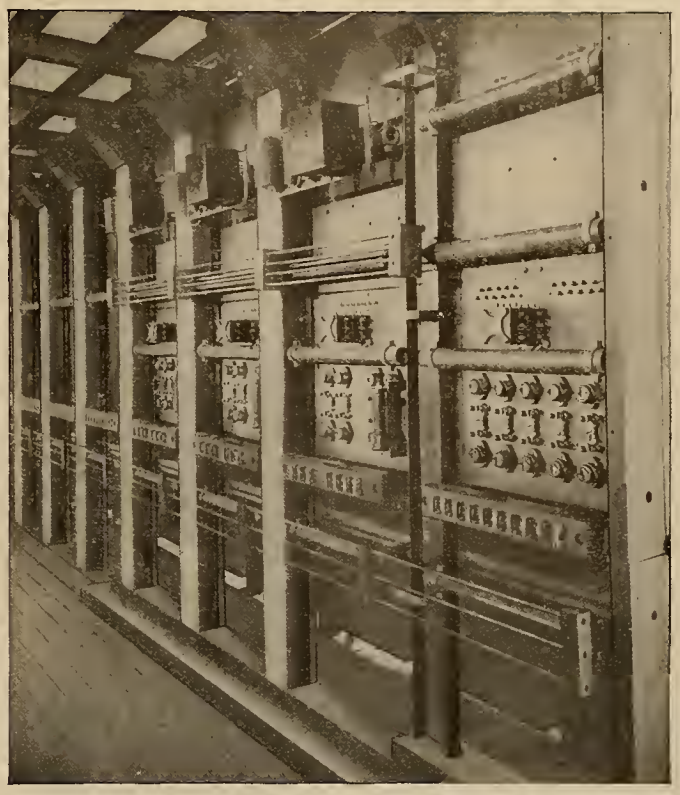
The system of connection throughout is the double bus, double switch scheme, with provision for disconnecting any oil switch for cleaning or repairs without interrupting the circuit. This system was naturally selected for this station because it was considered the most flexible for the requirement of uninterrupted service, which the engineers of the Isthmian Canal Commission have so carefully considered, though without superfluous complications.

Instrument and Control Board.

The main switchboard is of the benchboard type, with vertical rear board for relays, watthour meters, graphic instruments and the control battery equipment. The switchboard and all control apparatus were built by the General Electric Company. The space between the front and the rear boards is enclosed by grille work with doors at both ends, and a metal moulding extending along the floor and the top of the board gives a finished appearance to the whole. On the top of the switchboard is a second story, for the electrically controlled generator and exciter rheostats, accessible by means of a ladder inside the structure. The first panel from the left in the benchboard controls the ex-

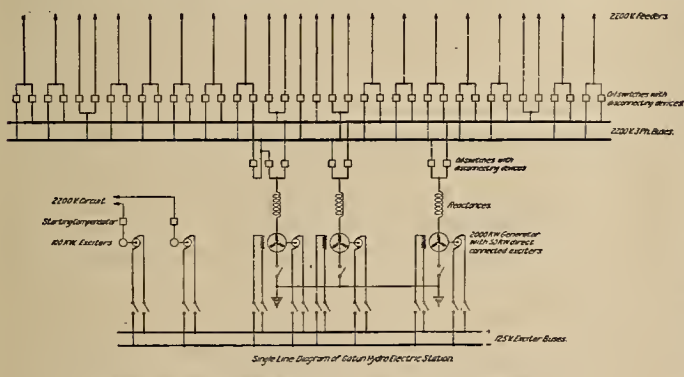


2200 Volt a.c. Instrument and Control Benchboard in Gatun Hydroelectric Station.



Interior of 2200 Volt a.c. Benchboard in Gatun Hydroelectric Station.

citers, the next three the generators and the remaining four the twenty-four feeder circuits. The system of connection is represented by dummy busses of polished copper on top of the bench. The interior view of the benchboard shows the arrangement of operating busses and fuses, potential busses, instrument resistances, and the channel iron risers with distributing tubes, which carry the instrument and control leads to their points of connection on the board.



Single Line Diagram of Gatun Hydroelectric Station.

A generator voltage regulator, transferable to either of the two sets of busses, is installed on a separate pedestal which also carries the synchronism indicators and clock.

As mentioned above, the exciters are controlled from the benchboard, but the electrically operated exciter switches and field switches are mounted on a separate board located so as to make the exciter connections as short as possible. This arrangement eliminates the exciter busses and the main connections from the control board, but leaves the control of the whole equipment in the hands of the operator.

Bus and Switch Compartments.

The bus and switch compartments are located on two galleries. On the upper gallery are located the control board near the end of the station that may be extended, the generator reactances, compartment for generator current and potential transformers, and the generator oil switches. From the oil switches, connections are made through the floor to the busses on the gallery below, on which gallery are also the feeder oil switches, and the compartment for the instrument transformers and cable bells. On the main floor just below this gallery is the cable vault with racks for the feeder cables.

All compartments are built of concrete with flame-proof doors. The busses and connections are made of solid copper rods of sufficient size to give a rigid construction even where the current is very small. After installation, the busses and connections and all joints are heavily insulated with varnished cambric to make them perfectly safe.

All the 2200-volt oil switches are solenoid operated and are provided with mechanism for readily disconnecting them for cleaning or repairs, all live parts being completely covered. The same form of disconnecting switch with slight modification is used for the hand-operated and the solenoid-operated switches. This is shown in the accompanying illustration. A mechanical interlock prevents raising or lowering an oil switch while in the closed position.

The shipping weight of the material furnished by the Pelton Water Wheel Company, including the auxiliary electrical apparatus purchased by them from the General Electric Company, was approximately one thousand tons.

The complete hydraulic equipment for this installation, including the racks, headgates, pipe lines, Pitot tube testing apparatus, turbines, governors and oil pumping units, was designed and built by The Pelton Waterwheel Company; and all the electrical apparatus, including the generators, switchboards, transformers, head gate motors, limit switches, float switches, accessories and motors for driving the oil pumps, was designed and built by the General Electric Company. The details of design and manufacture of all this apparatus were subject to the approval of the Isthmian Canal Commission's Engineers.

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Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advanace of date of issue.

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FOUNDED 1887 AS THE
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Wanted, a Coherer

The growing greatness of the German Empire is due largely to a unity of purpose, prompted by love of the Fatherland, causing them to cohere in an almost perfect manner.

When unification under the same thought or principle exists the connection of events is more readily detected and it is then easier for the aspirations of individuals to be made, willingly or otherwise, subservient to the interests of the commonwealth.

Proximate emoluments and honors are sacrificed to the general good though ultimately the individual also benefits.

While none will question the innate love of flag and country on the part of all citizens of the United States and the consequent existence in large measure during times of strife of that prime coherer, patriotism, it must also be recognized that unification of purpose is sadly lacking in matters pertaining to the commercial prosperity of the nation.

Coherency depends upon the existence and recognition of a common principle and purpose and until this is appreciated and the statesman big enough to declare that principle and to co-ordinate conduct under its general acceptance appears, there will be but disruption of business and destruction of common interests, although the purpose of individual though disconnected effort be never before so honest and sincere. There must be a logical consistency in administration.

Two opposite experiments in the control of business should not be allowed to be conducted at one and the same time, else how and when it is to be learned, just what is best.

In the early days of wireless telegraphy the coherer was an important part of the apparatus, necessary to the passage and detection of the oscillations set up by the high tension high frequency currents which were too subtle to be detected but by a superhuman sense.

And the statesman who with logical consistency shall bring harmony into the ranks of those who would regulate and who will readily detect the currents of thought which themselves uncontrolled will destroy the needed big business of the country, will also prove a coherer of almost superhuman sense.

A secretary of the interior of broad outlook stated that the generation of hydroelectric power was a natural monopoly and this belief later received the seal of approval in the utterance of one of the greatest electrical engineers who foresaw the realization of a nation-wide transmission system analogous to the railroads.

On every hand commissions are controlling those quasi-public utilities which give the least excuse for being considered such. This control almost invariably assures a justifiable monopoly to the corporation controlled.

Combination and monopoly in connection with the highest hydroelectric development are apparently essential.

But almost before the need for monopoly has been established or the value of commission control realized plans are proposed in order to curb this "menace" of monopolistic combination.

It is inconceivable that ihts "Banquo's" ghost of the electrical industry should be again induced to walk and while no one will question the honesty and sincerity of purpose on the part of the conservationist member of the committee on public lands now endeavoring to curb the combination of hydroelectric development interests, it must be conceded in view of the foregoing discussion of the situation, that the time is immature and the action proposed not in agreement with other endeavors to accomplish the same end.

There is a need both for coherency and the coherer.

In the German Empire, a successful outgrowth of the practice of this principle of coherency is the encouragement of big business, for combination though deservedly benefitting a few in larger measure is also seen to be conducive to the general good.

When men fail to observe the logical order and connection of events unification is destroyed, the ghost of disruption appears and Hamlet's classical statement regarding the state is seen to be still true.

The individual's pursuit of self is always unsatisfactory, for at the end he finds that he is chasing a shadow.

A Unified West

Arising early he flees the dawn of co-operative effort with its superior purpose born of interest in the industry, and chases the shadow of self with seeming success until, fatigued, he sleeps through the effulgence of co-operation's noonday which would have proved to him the absurdity of his endeavor. Awakening he finds that the shadow still eludes him as the return journey again degenerates into a chase of selfish interest until the shadow finally merges into the falling darkness, and is lost.

Preparedness alone will permit profit and each must appreciate his relationship to the rest in order to enjoy the utmost good.

This then is a plea for participation.

With such a wealth of gas and electrical engineering and allied association conventions being held at San Francisco during 1915, conventions of international in addition to those of national importance, it is essential to at this time review the state of preparedness of the Pacific Coast to the end that the utmost benefit to the various industries and their branches, be derived from these events.

It would be disappointing indeed to have visitors to the Coast return whence they came with the idea that 1915 was but a boom year here in engineering affairs, and that the world-breaking feats, of which all are so justly proud, are but the grand-stand plays of individuals forced to the issue by the necessity for coping with them.

At that time there must be present the solidarity of purpose and the complete and impenetrable front of a unified West.

This is the bending moment in our experience and the supreme test of the interpretation of this spirit of getting together or co-operation, and no matter how remote one phase of activitiy in any industry may be from any other in the same industry, all are interdependent and should work together to a common end.

The porcelain primary fuse plug is a plain and seemingly insignificant link judging from its appearance on the pole, but if put out of service it is found to be of greater importance to the success of all than is the ornate lighting glassware or the nickel plated appliance. The opposite argument also holds good and this interdependence exists in all industries.

Recognition of this should be followed by a willingness to participate.

Company sections, locals, and geographic sections of all associations should this year have such an increase in membership that no one will be excluded.

Then will exist a still greater opportunity for the formation of that main Pacific Coast organization which shall co-ordinate the efforts of all these to the end of more effective action in matters of local interest and of a unit participation in the activities of national organizations.

The sales force of any institution is composite, being partly advertising, partly inherent value of the thing sold, and partly salesman.

Strengthening the Sales Force

Consideration of the second factor would be too wide a subject to discuss in an editorial, as is also the case with the other two factors, the strengthening or most efficient utilization of which constitutes two separate, though closely associated, sciences.

It is possible though, to make a suggestion which if adopted will, by closer team-work between the factors first and last mentioned, result in strengthening the sales force and in furthering its effectiveness.

In advertising, it is elementary to say that it is profitless, figuratively speaking, to use space for the presentation of fur clothing in California, or to endeavor to interest those in zero regions in the merits of an outdoor sleeping porch.

But territorial salesmen often find that the national advertising of their firm benefits them no better than would such blunders. Their advertising entree to customers and prospects is nil, and this indicates that maximum effectiveness is not secured from advertising appropriations thus carelessly used, no matter how great the pulling power of the copy presented. At the same time the salesman is handicapped through the absence of real advertising support.

What is needed is that the salesman first write the advertising, not to the exclusion of the advertising department as at present existing, but to enlarge its service. The salesman would also benefit.

Ad-writing carried out in a conscientious, thorough and intelligent manner is one of the surest methods of learning the good points about a commodity and of what is necessary in order to make a proper sales presentation. And if the salesman is honest and sincere he will also acquire an extensive command of language and thereby learn to express his complete sales talk in a clear and concise manner.

The advertising manager will learn directly through the adoption of this plan, just what the salesman would prefer advertised in his particular territory, and this would result in the elimination of much of the present waste of words and white space in uselessly endeavoring to sell the unsuited or unsalable.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

R. Q. Clevenger of the Phoenix Glass Company is at Seattle.

H. E. Sanderson of Bryant, Perkins Company was a Seattle visitor during the past week.

I. H. McCarty has been made engineer of the Rector System of gas heating at San Francisco.

Stanley Pearce, city electrician, Sacramento, Cal., was at San Francisco for a few days during last week.

W. L. Overman, representing the Hughes Electric Heating Company of Chicago, is making a trip in Oregon.

J. NePage of NePage, McKenny & Company, Seattle, Wash., was a San Francisco visitor during the past week.

W. C. Behan of Westinghouse Electric and Mfg. Company, San Francisco, is on a trip to Lake Tahoe and Sierra region.

P. M. Longan, the new comptroller and treasurer of the Mt. Whitney Power and Electric Company of Visalia, is at San Francisco.

R. D. Power of the Nevada Electric and Machinery Company, Reno, Nevada, spent several days in San Francisco during the week.

J. E. Newlands, purchasing agent, San Joaquin Light and Power Company, Fresno, was a visitor to San Francisco during the week.

G. Douglass Jones, State Electrical Engineer, Sacramento, is conducting a series of lamp tests at the University of California, Berkeley.

Carl V. Heise, San Francisco manager Westinghouse Electric & Manufacturing Company, is spending a vacation in the Yosemite Valley.

F. J. Cram, sales manager, Electric Appliance Company, San Francisco, has just returned after a couple of weeks trip through the north of bay counties region, California.

T. E. Collins, sales manager for the Westinghouse Electric and Mfg. Company, San Francisco, returned Tuesday after a ten days' trip to Los Angeles and Southern California.

H. C. Moss, illuminating engineer at Seattle, is designing the electrical equipment for the Royal Jubilee Hospital at Victoria, B. C. The hospital will have its own plant, consisting of 2-100 kw. and 2-50 kw. turbo-generator sets.

S. K. Colby, formerly vice-president of Pierson, Roeding & Co., San Francisco, now vice-president of Allen & Peck, Inc., Baltmore, is in San Francisco with his family, and contemplates spending several months on the Pacific Coast.

C. H. Johnson, formerly with the Western Electric Company as salesman in pipe line department, has resigned to represent the C. A. Wood Preserving Company of St. Louis and has opened offices in the Rialto Building, San Francisco.

W. H. Whitson is at Fall River Mills, Shasta County, California, from Redding, and has assumed charge of the construction of the power lines of the California Power and Manufacturing Company, under Chief Engineer C. Kormel of San Francisco.

Charles T. Phillips, consulting engineer, San Francisco, gave a lecture June 22nd, before the Twin Peaks Federation of Improvement Clubs on "Street Lighting." There is a movement to better the street lighting in that district and this lecture will be given at intervals to stimulate interest.

Chas. H. Day, efficiency engineer of Altoona, Penn., gave a short talk at the University Club, Portland, Oregon, the evening of June 17th, to about 25 representatives of the various public service utilities. Mr. Day is of international reputation and his talk was greatly appreciated by all present.

T. E. Bibbins, local manager of the General Electric Company, San Francisco, is expected back from the East the early part of next week, after an absence of several weeks, during which he attended the National Electric Light Association convention and visited the company's plant at Schenectady.

J. F. Heath and **C. F. McDonald** of the Jovian Order, reached Salt Lake City last Tuesday on their around the world trip which is being made "without purse or scrip" as it were, on a bet which the boys made. They have changed their original plans which comtemplated a passage through the Panama Canal and thence eastward and are going overland. Their next stop will be at Omaha.

Wm. A. Bole has been elected by the directors of the Westinghouse Machine Company, vice-president in charge of production and erection for the plants at East Pittsburg, and at Trafford. Mr. Bole has been in the continuous employ of the company since August, 1882, having successfully filled the positions of general shop foreman, superintendent, manager of works and consulting engineer, and has therefore taken part in the growth and development of the company since it employed less than 100 men until the present, when the total forces run up into the thousands of operatives.

H. M. Byllesby, president, and **John J. O'Brien**, vice-president and general auditor of H. H. Byllesby & Company, left Chicago June 14th for an inspection of the public utility properties managed by this company on the Pacific Coast, including those in the cities of San Diego, Stockton, Richmond and Eureka, California, Tacoma, Olympia and Everett, Washington and various communities in the State of Oregon. **Otto E. Osthoff**, vice-president and chief engineer, and **Elmer Dover**, vice-president in charge of the Pacific Coast properties, will accompany them. Messrs. Osthoff and Dover are now in the West.

C. L. Cory, professor of electrical engineering at the University of California, has returned to San Francisco from an Eastern trip. While in attendance at the fortieth commencement of Purdue University, he was honored with the degree of Doctor of Engineering. This is the third honorary degree which the university has conferred, the first being upon Dr. Elwood Meade, formerly head of the Irrigation Department of the University of California, and now in charge of the Australian government's irrigation of land enterprises, and the second upon Dr. Angus Sinclair of New York City. Dr. Cory graduated from Purdue with the class of 1889, whose twenty-fifth anniversary he also attended.

James M. Barry, chief of the San Francisco Department of Electricity, called together a representative gathering of electrical contractors, workers and inspectors at a local cafe on June 23d to discuss the present electrical ordinance. This was discussed section by section, it being the unanimous opinion of those present that the ordinance as it now stands is inadequate. The subjects of an examination for contractors, the raising of the license fee and the elimination of inspection fees, and the proposition of all conduit work instead of knob and tube were also discussed during the evening. The meeting should be productive of much good in creating a better feeling and understanding among all parties concerned.

R. A. Thompson, member of the Engineering Board of the Interstate Commerce Commission, Pacific District, with headquarters in San Francisco, is preparing to take inventories and make valuations of the properties of the Western Union and Postal telegraph companies and the American Telegraph and Telephone Company. The work is to be done under the provisions of the Valuation Act of 1913. **R. W. Gray**, present district superintendent for the Western Union Company, has been appointed senior telegraphic engineer and staff officer for the newly authorized labors of the Interstate Commerce Commission. The Pacific district of the Interstate Commerce Commission comprises California, Oregon, Washington, Arizona, Nevada, Idaho, Montana, Utah, Wyoming, New Mexico, Alaska and the Philippines.

MEETING NOTICES.

Sacramento Jovian League.

At the Jovian luncheon Saturday, June 20th, a committee was named to make arrangements for holding a rejuvenation at the close of the Contractors' and Dealers' Convention on August 8th. Assurances of a large number of candidates have been given and Statesman Pearce plans a most creditable rejuvenation. The degree team is as follows:

Jupiter, G. Stanley Pearce	Neptune, J. H. Middlemess
Mars, W. C. Dolan	Vulcan, C. A. Lamas
Pluto, J. C. Hobrecht	Mercury, C. R. Gill
Apollo, R. C. Eyerly	Avrenim, L. A. Schloss
Hercules, J. C. Toby	

The Jovian Electrical League of Southern California.

Over 125 Jovians attended the weekly luncheon at Christophers on June 17th, which was presided over by C. Adolphus Renard. Among the guests who were introduced were Mr. Collins of the San Francisco office of the Westinghouse Company and Messrs. Peart and Carpenter of the San Joaquin Light and Power Company. A splendid musical program was rendered by professional talent and the Jovian quartette. A splendid address on patriotism and co-operation was delivered by the well-known woman lawyer, Mrs. Clara Shortridge Foltz, who lauded the league highly for the co-operative spirit displayed by its members.

Utah Light & Railway Company Section N. E. L. A.

The employes of the Utah Light & Railway Company held its first summer outing which was the final regular session of the winter season at the beautiful Pinecrest Inn at the head of Emigration Canyon which is reached by the electric line of the Emigration Canyon Railroad Company. The 150 employes and ladies left the city on the 2:30 train and spent the balance of the afternoon tramping over the hills and resting in the countless shady nooks which make this mountain resort so pleasurable. At 6:30 p. m. the company sat down to the celebrated trout and chicken dinner served by the Pinecrest Inn. At the conclusion of the dinner short toasts were responded to by G. B. Walker, Wm. Scott, and A. W. Milgate. F. A. Keyworth acted as toastmaster. Mr. Lloyd Garrison read the Company Section "Gimlet," which contained numerous jibes on the various company employes. Hy. C. Dunbar, the popular comedian from the line and service department, provided his usual fund of amusement. At the conclusion of the dinner the following officers of the Company Section were elected for the ensuing year: President, A. E. Kennelly, lines and service department; Vice-president, W. E. Turner, engineering department; Secretary and Treasurer, E. C. Cathcart, storekeeper. The party then adjourned to the hotel ball room where dancing was the order of the evening until the return of the special train.

Los Angeles Section Electric Vehicle Association.

With the object of promoting the use of the electric vehicle in Southern California, for both business and pleasure, prominent men interested either directly or indirectly on last Friday evening organized the Los Angeles section of the Electric Vehicle Association of America. The new organization was launched with a membership of thirty-one, and will hereafter hold meetings each month. One of the first objects the new association will seek will be the establishment of adequate electric charging stations in every important town in Southern California in order that the range of usefulness of the electric vehicle will be greatly extended.

The following are the officers and members of the new organization: Chairman, J. Harry Pieper, Southern California Edison Company; Vice Chairman, Harry W. Harrison, General Vehicle Company; Secretary, James F. Rogan, Edison Storage Battery Company. Executive Committee: G. B. McLean, Pacific Light & Power Corporation; A. T. Smith, Firestone Tire & Rubber Company; J. O. Case, General Electric Company; Harry J. Kister, Los Angeles Gas & Electric Corporation; Earl C. Anthony, California Motor Company; I. R. Solomon, Gould Storage Battery Company; Charles Carter, Pacific States Electric Company; Volney S. Beardsley, Beardsley Electric Company.

Members: John B. Miller, Southern California Edison Company; S. M. Kennedy, Southern California Edison Company; J. Harry Pieper, Southern California Edison Company; C. P. Houghton, Los Angeles Gas & Electric Corporation; H. J. Kister, Los Angeles Gas & Electric Corporation; J. F. Rogan, Edison Storage Battery Company; H. W. Harrison, General Electric Company; Volney S. Beardsley, Beardsley Electric Company; John D. Shannon, Beardsley Electric Company; I. R. Solomon, Gould Storage Battery Company; R. H. Morris, Electric Car Exchange; A. T. Smith, Firestone Tire & Rubber Company; Earl C. Anthony, California Motor Company; Charles Carter, Pacific States Electric Company; W. F. Rath, Electric Storage Battery Company; C. H. Kay, Kay & Burbank, Pasadena, Cal.; A. C. Kendall, Kendall Auto Company, Pasadena; J. O. Case, General Electric Company; W. E. Kerrick, Wilshire Auto Company; C. B. Lamoree, Westinghouse Electric & Mfg. Company; A. H. Sweetland, National St. & Sta. Ind. Co.; T. E. Felt, 1837 West Thirty-eighth street, Los Angeles; R. R. Thomas, Electric Equipment Company; Carl Klemp, California Electric Garage; A. S. Morton, California Electric Garage; E. R. Davis, Pacific Light & Power Corporation; G. M. McLean, Pacific Light & Power Corporation; A. W. Harrison, Los Angeles Creamery & Auto Company; E. B. Moore, Los Angeles Creamery & Motor Company; S. S. Wilder, Kendall Auto Company.

Annual Picnic of the Jovian Electrical League of Southern California.

At the annual picnic of the Los Angeles Jovians between 600 and 700 loyal Jovians, their families and friends journeyed by autos and special trains to beautiful Verdugo Park, and from early morning until the sun had set it was "all together, all the time, for all the fun and sports." And plenty of each there were, furnished by the highly efficient committees, from the baseball game in the morning to the dancing and awarding of prizes before "going home" time.

The ball game between the manufacturers and jobbers against the power companies and contractors was played at high pressure, so that the final score was 1 to 0 in favor of the manufacturers and jobbers, whose bats offered considerable resistance to the balls passing between their opponents' batteries. The decisions of Umpires Francis and Woodill required frequent transformation and considerable good-natured reaction was evident at times.

After this heated contest, everyone adjourned to the well-shaded grove, where boxes and baskets were opened by the score and emptied by the hungry crowd, who were treated to ice cream, coffee and "soft drinks only" by the league. A panoramic photograph of the multitude was then taken with the high Sierras as a background and then the program of athletic contests was begun. It having been announced that prizes aggregating $300 would be offered, there were many entries for each event, and it has been stated that some national records were broken or at least equaled.

Dancing was indulged in for many hours, splendid music being furnished by a band brought from the city. Much credit for the success of the picnic is due to the officers of the league and special committees, appointed by Chairman Colkitt. They were as follows:

Executive committee—G. E. Arbogast (general chairman), A. B. Day, F. J. Airey.

Transportation committee—J. C. Rendler (chairman), W. A. McNally, O. D. Harris.

Publicity committee—H. W. Allen (chairman), R. J. McHugh, E. A. Taylor.

Sports committee—C. E. Spaulding (chairman), E. B. Clay, L. E. Darrow.

Prize committee—P. C. Reed (chairman), G. H. P. Dellman, F. E. Lehman.

Finance committee—J. E. MacDonald (chairman), J. O. Case, A. G. Drake.

Entertainment committee—J. E. Tucker (chairman), R. B. Clapp, C. B. Capps, R. H. Manahan, R. H. Sterling, J. L. Gray, C. B. Hall, E. R. Northmore, S. J. Keese, E. L. Lewis, R. B. Rawls, H. B. Lynch, W. J. Gracey.

It is of interest to note, to give further evidence of fraternalism, that on the day of the picnic every electrical concern in Los Angeles closed its doors.

CALIFORNIA ASSOCIATION OF ELECTRICAL INSPECTORS

Section of N. A. E. I.

C. W. Mitchell, President. Arthur Kempston.
Wm. G. Pennycook, Vice-Pres. B. C. Hill, Executive Comm.
John W. Carrell Secretary-Treasurer, 55 Fulton, San Francisco.

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correllate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

By the Secretary.

The C. A. E. I. held their June meeting in San Jose Saturday afternoon, the 20th. The subject was Centers of Distribution. Those in attendance were C. W. Mitchell, Underwriters; Wm. G. Pennycook, Arthur Kempston, J. W. Carrell, San Francisco; B. C. Hill, T. A. Ellison, P. A. Anderson, Oakland; S. G. Pierce, Sacramento; F. M. Miller, Fresno; Jas. I. Dixon, Santa Clara; W. A. Spencer, San Jose. Mr. Dixon of Santa Clara has achieved the distinction of being the first city electrician to arrange his automobile fire apparatus to be started from the central fire alarm station.

The following is the correlated result of discussions on main service wiring, subject to further revision for precision and clearness:

Main Service Wiring.

Definition: In so far as these interpretations apply the term main service wires shall mean all wires in or on buildings or structures, extending from the place of connection to the source of supply to the main service cut-out and switch.

Interpretation of Rule 23, Section A.

Cut-Out Locations: The service cut-out must be located at the nearest accessible place to the point where the wires enter the building; that is, at the nearest point where the rules for the location of cut-outs can be complied with. In buildings supplied from underground the service cut-out must be located at the place where the wires protrude through the basement wall; where basements are not accessible this cut-out must be located at the nearest place where the rules for location of cut-outs can be complied with to a line vertical to the point where the wires project from underground.

For buildings supplied by overhead wires the entrance cut-out may, if all the service wires are enclosed in conduit embedded for the entire wiring distance in fire-proof construction, be located at any desired place where the rules for installation of cut-outs can be complied with. Where service wires are protected by cut-outs placed in a hood or cabinet at the outer end of the service conduit (as in cases where conduit enclosing service wires is concealed in non-fireproof construction) the hood or cabinet must be located near a window of the second story or in a place of equivalent accessibility so as to permit of easy inspection or replacement of the fuses; in this case the fuses may be of the rating allowed by Rule 18 for other than rubber insulation but an additional cut-out located inside the walls must protect the main service wires in accordance with Rule 18 for rubber insulation.

Main Service Switch.

Interpretation of Rule 24, Section A.

The main service switch must be either located in, or arranged so that it may be opened and closed from one of the principal entrances of the building and in a place which is easily accessible from the street, (access to the premises is assumed). Where this switch is both in plain sight and easily accessible from one of the principal entrances this interpretation is deemed complied with.

Must be protected by the main service cut-out unless the cut-out and switch are of combination type and mounted on the same base; must be so connected that the blades will be dead when the switch is open; must be located within 7 ft. from the floor.

Wires: Must be large enough to transmit current for the full capacity of all circuits which are installed and to provide start-current for the largest motor that may be connected to the system. In the case of lighting circuits, this means at least six amperes for each circuit which is installed.

The neutral of a three-wire system must have a safe carrying capacity, sufficient to transmit current for the maximum possible load to which the neutral is connected.

Must if installed underground have an approved lead covering; but a lead covering will not be required for the grounded neutral of a three-wire system.

Conduit: Must not, if enclosing wires not protected by automatic cut-outs, be concealed in any non-fireproof construction, except that it may pass through the outer wall of a building at right angles to the vertical plane thereof, and must not be run exposed on the outside of any building for a wiring distance which exceeds thirty feet.

A FUSELESS ROSETTE.

(By H. B. Rodgers, Pacific States Electric Co.)

A key socket said to a fuseless rosette,
"I am the main works here, you bet.
All you do is stick to the wall
And hold a cord, that's all—that's all.
I turn on and off the light.
If they want it dark or want it light,
I'm the one they come to see—
Not you my boy, they come to me."
"I admire your nerve," said the New Code Cord,
"And the trust you put in the dear old Lord.
If it wasn't for this old twisted pair,
How long would you stick in the air?"
"Please put me wise," said a 40-watt,
"Where you get that Tommy rot,
Your only excuse for living, I know,
Is because I'm hanging here below."
"Your talk," said the rosette, "Is simply hunk,
When you burn out, your name is Junk.
I don't like to brag, for well you know
I have no fuse up here to blow,
But if from me you don't get fed,
The whole darn bunch of you are dead;
And so each night ere you retire
You socket, lamp and twisted wire,
Say your prayers, but don't forget
Pray, the screws hold fast in this rosette."

ELECTRICAL CONTRACTORS' NOTES

W. H. Smith Electric Company has the electric contract for remodeling the electrical installation in the Arcade Theater, Portland, Oregon.

C. N. Rierdan has the electrical contract for the installation of the electrical equipment of the new Ice Hippodrome, Portland, Oregon.

Morrison Electric Company has the electrical contract for the B'nai Brith Building Association Club House. at Thirteenth and Mill streets, Portland, Oregon.

The West Coast Engineering Company has the electrical contract for the new four story apartment house being erected by J. R. Whalen at Seventeenth and Everett streets, Portland, Oregon.

Pacific Fire Extinguisher Company has obtained the electrical contract for the building being erected by the estate of Z. W. Whalley and W. T. Muir, on the southwest corner Pine and First streets, Portland, Oregon.

NEWS NOTES

INCORPORATIONS.

SAN BERNARDINO, CAL.—The Watervale Water Company of Victorville, capitalized at $26,200, has filed articles of incorporation. Reginald Frost, E. E. Richardson and W. W. Richardson are named as directors. Victorville is the principal place of business.

TUCSON, ARIZ.—The Silver Lake Water Company has filed articles of incorporation with a capital stock of $350,000, the incorporators being Gustave J. Magenheimer, Chicago, Ill.; Parl F. Magenheimer and Harry Hughes, Tucson, Arizona. The principal place of business is Tucson.

SAN DIEGO, CAL.—The Perfect Protection Telephone Company has been organized with a capital stock of $50,000, to market a sanitary telephone mouthpiece. The incorporators are Josephine A. Hall, S. M. Hall, Sarah E. Swisler, F. F. Johnson, and S. K. Johnson, all of San Diego.

SAN DIEGO, CAL.—Articles of incorporation have been filed of the Bay Shore Railroad Company, capitalized for $200,000, to build a railroad from the Ocean Beach terminus of the Ocean Beach Railroad across the inlet of False Bay and along the peninsula to a point near La Jolla. The incorporators are Chas. W. Fox, Geo. L. Barney, Gordon Decker, John F. Forward Jr., and J. H. McKie. The capital stock is divided into 2000 shares of $100 each. The proposed improvement will include the construction of an electric way, of a boulevard along the peninsula and bridging of False Bay.

ILLUMINATION.

SAN JOSE, CAL.—The Willow Glen lighting district adjoining San Jose on the southwest was formed recently by a special election.

MONROVIA, CAL.—The Pacific Light & Power Corporation has been granted a franchise to operate and maintain electric pole and wire system in the town of Arcadia.

EUREKA, CAL.—The Western States Gas & Electric Company has been granted a franchise for stringing wires and placing poles along the county road on Table Bluff from Perrott's ranch to Singley's station.

RAYMOND, WASH.—The county commissioners have granted to W. P. Cressy of South Bend a 25 year franchise to lay pipes and mains for the distribution of gas in all highways of the South Bend Land Company's Addition, Hyde Park Addition and territory lying between South Bend and Raymond.

OGDEN, UTAH.—Upon the recommendation of the city engineer the board of city commissioners authorized the extension of the "white way" to include three more streets in the business district of Ogden. The engineer was ordered to take the matter up with the Utah Light & Power Company, the Ogden Rapid Transit Company and the Webber Club immediately. Lights will be placed on steel poles on both sides of Twenty-fourth street between Washington and Wall avenues, on Grand avenue between Twenty-fourth and Twenty-fifth streets. When this work has been completed all streets within the business district will be lighted by the modern system.

TRANSMISSION.

TACOMA, WASH.—An ordinance has been passed providing for the Seattle Tacoma Power Company to place all electric wires in underground conduits.

NOGALES, ARIZ.—Announcement has been made by the Nogales Electric, Ice & Water Company that it will in the near future commence the erection of a new power plant just north of the big foundry and machine shops on Grand avenue.

LOS ANGELES, CAL.—The city council has authorized the engraving of $1,482,000 of power bonds and the repealing of the resolution adopted some weeks ago. The new resolution provides for paying off of the bonds (first) on August 1, 1914, instead of 1915, as per the first resolution.

EL DORADO, CAL.—The California Mining & Dredging Syndicate, operating the Shaw mine at Eldorado, are installing electrical equipment throughout. A two mile transmission line to connect with the lines of the Western States Gas & Electric Company and a transformer station are being installed by Bendel & Bendel of Oakland.

EUGENE, ORE.—C. A. Elkins and Frank Shelley of this city, have been awarded the contract by Richard Clow to erect and install a hydroelectric plant on a small creek near the town of Mapleton for the generation of electric power and light for that place. The creek will be dammed by a solid wall of concrete and the water will be conveyed to the turbine through a 12 in. pipe line 2000 ft. long. The water will have a fall of 100 ft. in that distance.

ABERDEEN, WASH.—C. E. Troutman has returned from Raymond and Southbend and states that the Willapa County Traction Company, Frank McKean of Seattle, president, is a factor of the Mason County Promotion Company and other corporations which have for their obpect the electrifying of all logging operations in Pacific, Chehalis and other counties, and in the developing of water power. According to a statement by Mr. McKean, the company owns rights at the headwaters of the Wynooche river and proposes to develop them.

LEHI, UTAH.—The power plants of the Utah Power & Light Company in this immediate section of the state, representing an outlay of more than a half million dollars, are rapidly being closed up and may remain idle for an indefinite period. The electric plant at Battle Creek, costing $150,000 has been closed for two months. The one at Alpine, costing $175,000, has also been recently closed down. The one at the mouth of American Fork canyon and the one two miles up in the canyon will be out of commission after July 1st. The four plants have a total capacity of more than 5000 h.p. The closing of the plants does not mean that the electric light and power service of this locality will be impaired in any manner, but that it is a policy of retrenchment being instituted by the power company. When the present owners formed the Utah Power & Light Company they took over twenty-four plants which had been built by almost as many companies. Each of them had a surplus of power, and when the amalgamation was perfected there was a vast aggregate of power that was not needed. As fast as the market for electrical energy is developed, the plants will be again placed in operation and it will not, therefore, be the policy of the company to sell or dispose of any of the closed plants. On the contrary, they will be kept in perfect condition, so that as they are needed, either for emergency purposes or for permanent use, they will be ready.

TRANSPORTATION.

SAN FRANCSICO, CAL.—H. S. Tittle has been awarded the contract for furnishing and installing overhead electrical conductors for the municipal railway line on his bid of $36,245.

OAKLAND, CAL.—Plans are being figured for a three story and basement class A railroad office building at Twenty-second and Grove streets, to cost $50,000, for the San Francisco-Oakland Terminal Railways, by Architects Milwain Bros.

SALT LAKE CITY, UTAH.—The Westinghouse Electric & Manufacturing Company commenced this week on the in-

stallation of electric equipment for the new Orem Interurban Electric Line to Provo. This work is in charge of W. A. Davis, installing engineer for the company.

OGDEN, UTAH.—The contract for building the electric railroad that will connect Ogden with Brigham, Logan, Lewiston and Preston, Idaho, has been let to the Utah Construction Company, according to an announcement made by P. D. Kline, general manager of the Ogden Rapid Transit Company.

SALT LAKE CITY, UTAH.—The Utah Light & Railway Company is preparing plans and specifications for an addition to its car barns to house the twenty-four new interurban cars which the company has on order and which will be delivered in the course of the next thirty days. The addition will cost $50,000.

SEATTLE, WASH.—Extension of the Lake Burien street car line, owned by the city, to the beach at Three Tree Point on Puget Sound, a distance of about two miles is a probability, if the plans of several large property owners between the present terminus and the Sound are carried out. These owners propose to build a line from Lake Burien to the beach and deed it to the city.

OGDEN, UTAH.—Plans are now under way for the consolidation of the Ogden Rapid Transit Company which operates the transportation system in Ogden, with the Logan Rapid Transit Company which operates the street car system in Logan. Construction work is already in progress on the interurban extension of the Ogden Rapid Transit Company's line from Ogden to Logan, a distance of 65 miles, the purpose of the consolidation being to have a unified system operating in the two cities and on the interurban connection when this is completed.

SAN FRANCISCO, CAL.—The San Jose Terminal Railroad, which is planning a new transportation line into San Francisco from the south has applied to the harbor commissioners for a terminal dock, stating that the construction of the electric line between San Jose and Alviso, a distance of 11 miles is now under way and that it is expected that it will be completed and ready for the intervening water service of 40 miles by January 1st of next year. The request was referred to the committee of the whole with the intimation it would be granted as soon as more definite information about the space desired and time of occupancy, is received.

SALT LAKE CITY, UTAH.—The city commissioners on the 18th of June granted to the Utah Light & Railway Company a 41 year franchise to haul express and mail matter over certain of its city lines designated in the franchise in order to reach a central freight and passenger depot contemplated by the company. This company has been extending its interurban lines south to Midvale, Murray and Sandy, southeast to Holliday and north to Bountiful, Centerville and Farmington during the past four or five years. These lines pass through a rich agricultural section which is devoted almost exclusively to extensive farming and truck gardens but the company has not been able to give these residents along their lines the benefit of the freight and express service which has done so much to build up interurban territory in other localities, on account of the persistent refusal of the city authorities to grant them a freight and express franchise. The present franchise was only obtained after many of the features which would have made it of greatest benefit both to the rural and city population had been eliminated. The company officials believe, however, that when the public have an opportunity to see the benefit derived from the operation of this system, that they will be able to secure an extension of their privileges along the lines of the features stricken from the franchise which runs for a period of 41 years and expires with the company's general franchises.

TELEPHONE AND TELEGRAPH.

OAKLAND, CAL.—The compromise between the city of Oakland and the Pacific Telephone & Telegraph Company upon the latter's acquisition of the Home Telephone Company was made effective by the passage of the necessary resolutions by the city council. Under the agreement the company will not forfeit the $100,000 which was to have been paid to the city in the event of the sale of the Home company. The purchasing company takes over the Home company franchise, which increases the life of its franchise grant of 13 years. Under the Home Company's franchise, assumed by the Pacific company, 2 per cent of the gross earnings will be paid to the city. The company also furnishes the city with 200 free phones.

SAN FRANCISCO, CAL.—The rate fixing committee of the board of supervisors has refused to sanction any advance in standard classes of telephone charges. By a readjustment of the rates the committee assured the Pacific Telephone & Telegraph Company of increased earnings that will aggregate $40,000 a year, but this readjustment will entail no increases in the standard classes of telephone tolls. The readjustment scheme abolished classes of service on which the company claimed it had not received just returns, and its increased earnings will be derived principally from the earnings that will accrue from the elimination of these classes. With the estimated $40,000 increase in revenue, the company will be receiving a return of more than 6 per cent on its investment. It received 5.75 per cent on the 1912-1913 rates, and would have received 6.90 per cent with the increases recommended by the engineers.

NORTH YAKIMA, WASH.—Arrangements were completed here recently between the members of the public service commission of Washington, in session here in the Pacific Power & Light Company valuation hearing, and Chairman Clyde B. Aitchison of the Oregon Railway Commission, for a meeting of both commissions in Portland, June 25th, with the executive officers of the Pacific Telephone & Telegraph Company. The plan includes taking steps toward fixing local, intrastate and interstate rates, and exchange rates for rural lines in Washington and Oregon, and so far as the company's lines extend into Northern California. The property investment is claimed to be as high as $90,000,000 and this is the first move toward general consideration of conditions by the commissions. The Washington commission some time ago consented to the placing in effect for experimental purposes a new schedule of rates based on air line distances. Both commissions are now working toward securing a physical valuation of the company's properties in their respective states.

WATERWORKS.

SEATTLE, WASH.—Bids will be readvertised at once by the city for the construction of the tunnel for the water mains under Lake Union, as all previous bids were rejected. The work will cost about $175,000.

PARKER, ARIZ.—The Sharp-Fellows Company of Los Angeles has taken a contract for the construction of a 50,000,000 gal. reservoir at Smith's Springs ,above Flagstaff, for the Santa Fe Railway Company. A storage dam is to be placed near Seligman in the canyon of Walnut Creek, to be connected with the Santa Fe Railway service by a 20 mile pipe line.

OROVILLE, CAL.—The irrigated area in the Thermalito orange and olive district is to be more than trebled during 1915, according to the plans of the Oro Electric Corporation, which now delivers water to about 1000 acres of land in the Thermalito district. Plans and specifications for enlarging the system to cover 3500 acres have been drawn. A. A. Davis, resident superintendent of the company, announced that the company expected to make these extensions to its system during the coming year.